Electrical World

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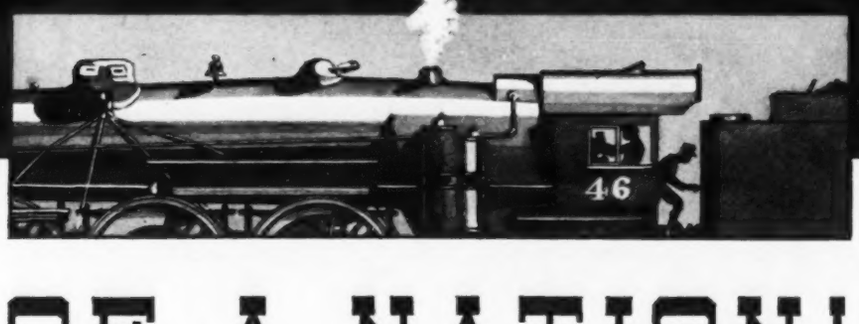

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When destructive short circuits build up terrific overloads, your good Murray Reactors dissipate the excess long enough to give the circuit breakers their "second wind."

They are, indeed, the safety valves of America's stream of electric power. They save costly shutdowns. They keep industry *humming*. They keep the bright lights of progress *burning*. Every utility *needs full* Murray Current Limiting Reactor protection. Metropolitan Device Corporation, 1250 Atlantic Av., Brooklyn, N. Y.

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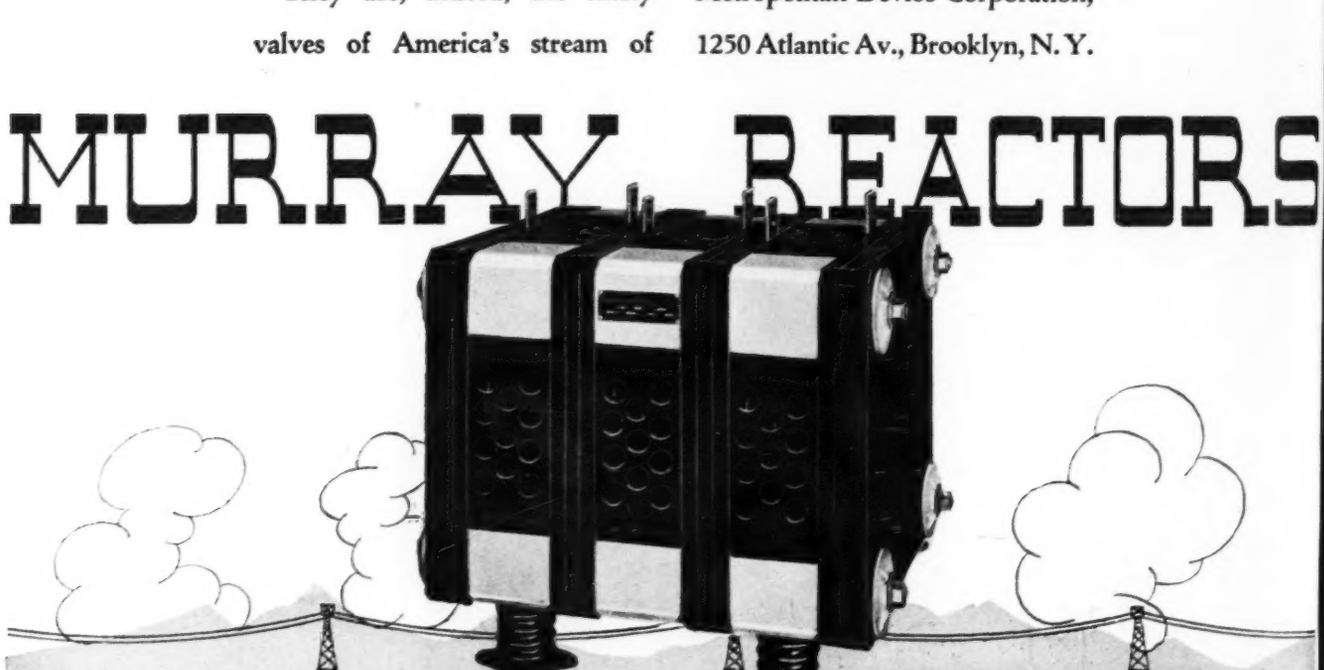

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 69 YEARS

June 10, 1944 — Vol. 121, No. 24

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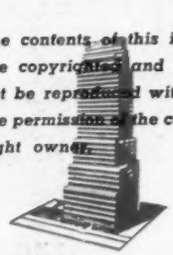

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To .....

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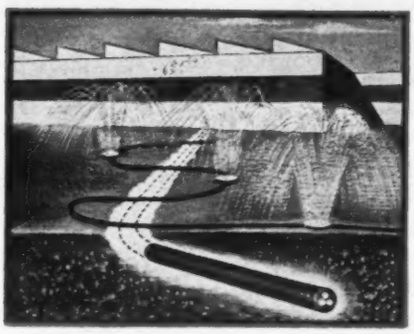
Signed .....

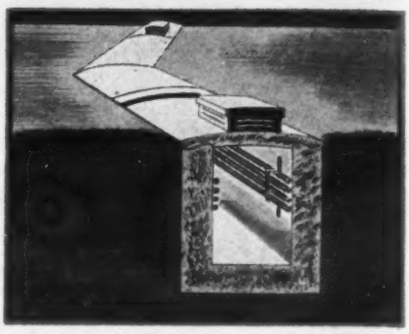
HOW TO DISSIPATE HEAT FROM *Underground* CABLES

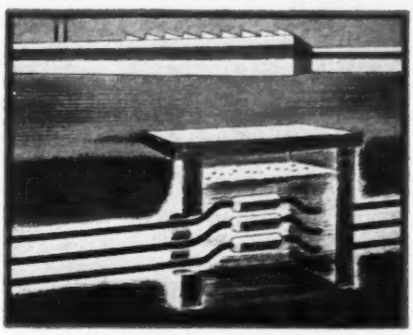
Cables buried directly in the ground or installed in ducts and tunnels will last longer and give better service if a few measures are taken to dissipate the heat which is so destructive to them. Here are some practical, time-proven suggestions.



In Underground Installations Without Ducts—keep ground saturated with water to lower the earth temperature and dissipate heat more readily.

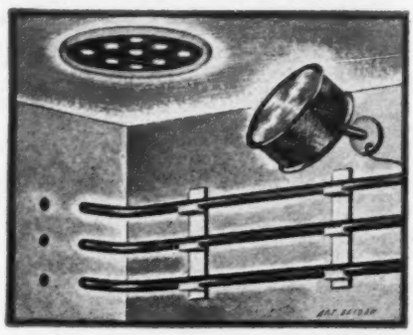
In Tunnel Installations—ventilate with grills where possible or install a blower at one end of the tunnel to force hot air out. Be sure circulation goes all the way through the tunnel so that hot air does not pile up at one end.





In Duct Installations—where conditions are serious circulate cool water when possible or flood duct lines and keep manholes flooded, being sure cables are watertight.

In Hot Manholes—install ventilating fans and perforate manhole covers to drive hot air out.



FROM THE START BE SURE YOU HAVE A HEAT-RESISTANT CABLE

and you go a long way to beat the heat enemy. Cables with Okolite moisture and heat-resisting insulation can be operated at 75° C. copper temperature to 8,000 volts. Write for Bulletin OK-2007A.

We are always glad to answer questions on cable design and operation. A wall chart (OK-2026) with the above and other valuable suggestions is available on request.

Write The Okonite Company, Passaic, New Jersey.

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Strand, Galvanized Guy
Switchboards, All Types
Switches, All Types
Systems, Sound
Tape, Friction
Tape, Rubber
Telephones, Intercommunicating
Tools, Pole Line Construction
Tools, Linemen's
Tree Wire Guards
Trucks, Line Construction
Trailers, Winches
Wire, Bare and Weatherproof Copper and Brass
Wire, Bare Resistance
Wire, Enameled Magnet
Wire, Iron and Steel
Wire, Lead Sheathed
Wire, Rubber Covered and Braided
Wire, Weatherproof
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. . . . THAT IT TAKES TO WIN!

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Announcing

A booklet entitled "A Report to Industry on Simplex Synthetic Rubber Insulations" is now being printed. You will want a copy because it is an up-to-date report of rapid progress and remarkable results in the transition during the past months from natural to synthetic rubber insulations and sheaths for wires and cables. It shows how Simplex quality is being maintained by the technical knowledge and manufacturing skill that enables us to get best results with the new materials.

The report contains valuable information that proves that synthetic compounds, when properly designed, are equivalent in service to the natural rubber insulations and sheaths they have replaced. Our chemical and engineering laboratories have done notable work in developing these new materials upon which we depend for Simplex quality and Simplex service.

As soon as the report is ready for distribution we would like to send a copy to you because we believe it will be of real interest. Your request for it by postcard or letter will receive prompt attention.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

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BAR CLAMP

LIVE LINE CLAMP

GROUND CLAMP

1 Designed for high strength and high conductivity - with a proper use of metal.

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- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- AIR BREAK SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- SWITCH OPERATING MECHANISMS
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R&IE CONDUCTOR FITTINGS

AILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

IN CANADA—EASTERN POWER DEVICES, LIMITED, TORONTO

This "194X" Substation

HERE'S A "DOUBLE-HEADER" DESIGNED FOR GOOD LOOKS

INDUSTRIAL PLANTS. THE ENTIRE UNIT IS DRY-TYPE--

WHEN the substation shown above is placed in operation, it will serve a large industrial plant with power for big motors and lighting substations . . . stepping down from 13,200 v. to 2300 v.

Note features of the new streamlined design. Several feet of floor space is saved by the concealed throat connection between transformers and switchgear . . . and there is no break in the smooth-flowing lines of the unit. Dry type transformers are efficiently self-cooled due to "chimney effect" of casing design.

Eliminating the element of liquid entirely, the new Allis-Chalmers magnetic air circuit breaker is employed in the vertical lift switchgear.

Substations of the type described will be offered for multi-circuit service in all sizes. Look for other important developments in electrical and power equipment from Allis-Chalmers. Maybe we can help you.

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A-C WE WORK FOR VICTORY WE PLAN FOR PEACE

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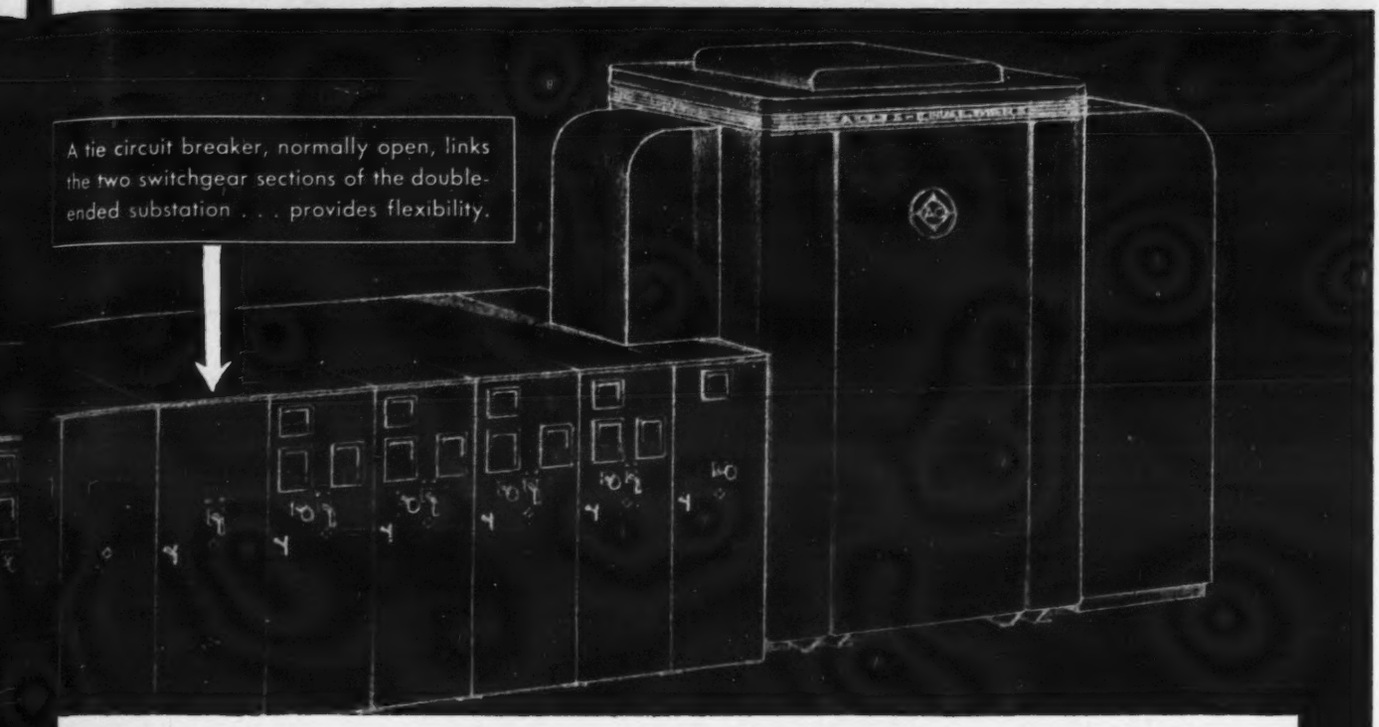
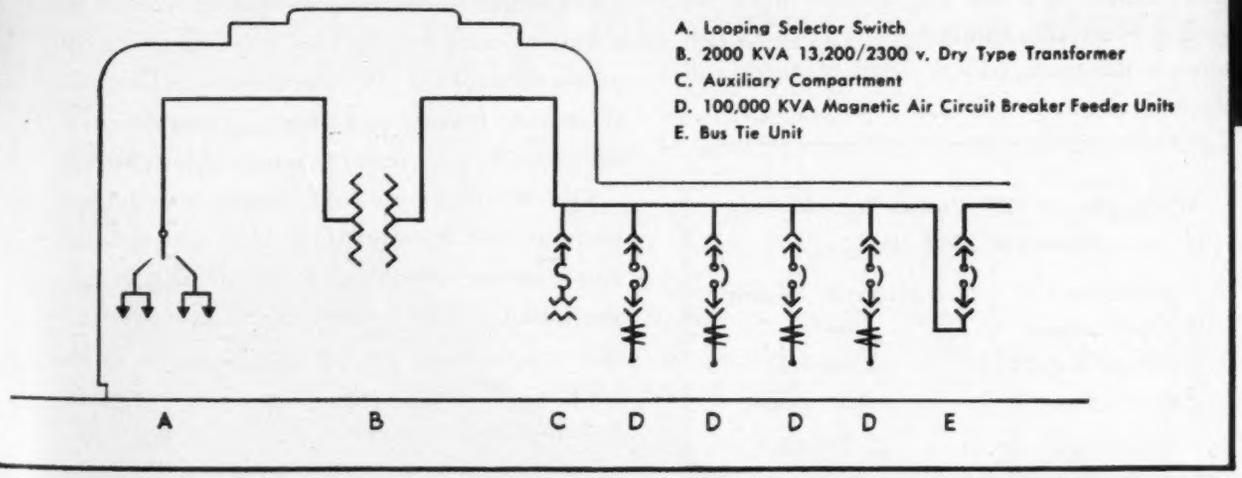
Can Be Yours Today!

AS WELL AS SAFE, DEPENDABLE SERVICE IN UP-TO-DATE

NOT A DROP OF LIQUID IN IT--AND IS RATED 4000 KVA.


A tie circuit breaker, normally open, links the two switchgear sections of the double-ended substation . . . provides flexibility.

SIMPLE ELECTRICAL DIAGRAM OF ONE HALF OF TYPE MCS DOUBLE-ENDED INDOOR UNIT SUBSTATION, RATED 4000 KVA



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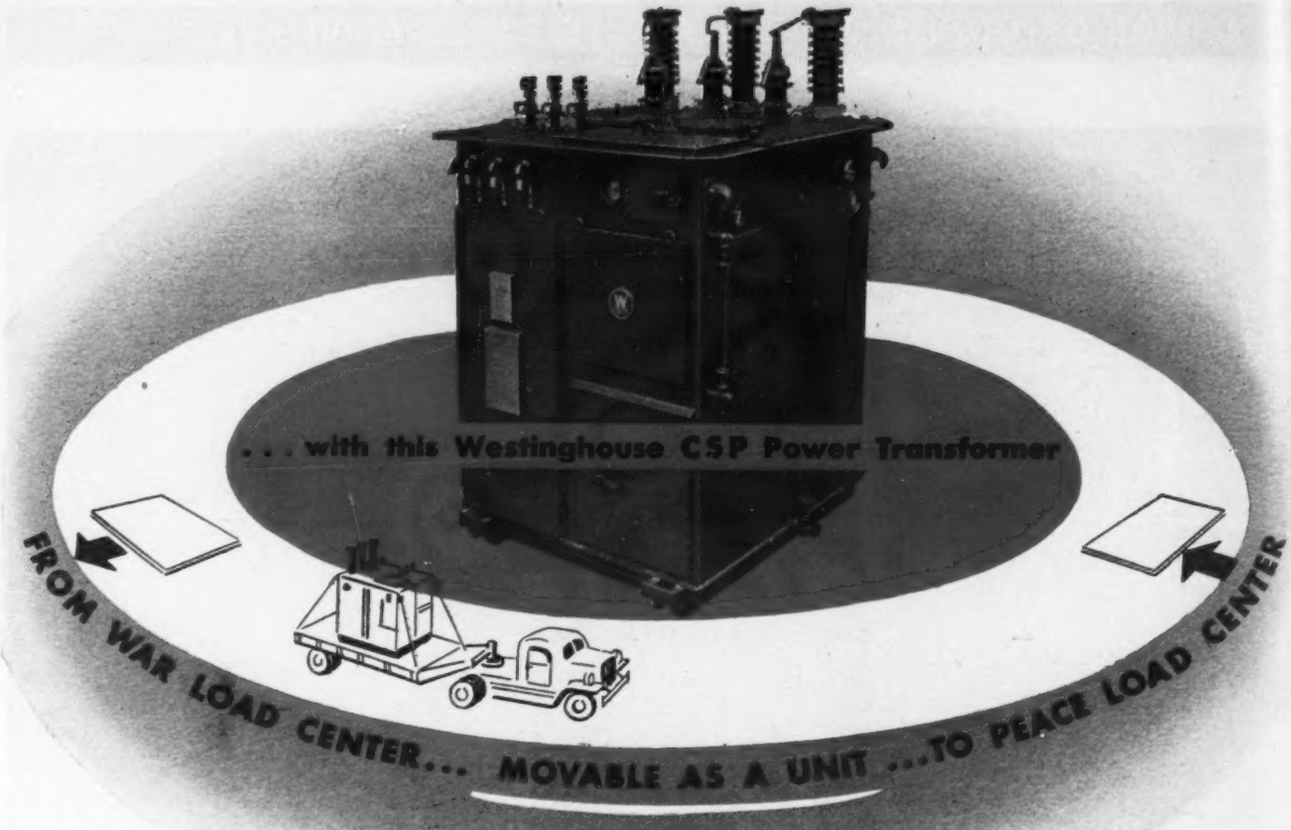


In a matter of hours, a CSP power transformer can be moved to a new load center. When the day of reconversion comes—just disconnect, roll onto a trailer-truck, take to a new platform, and reconnect.

Westinghouse CSP Power Transformers contain in *ONE UNIT*...

- transformer
- circuit breaker
- voltage regulator
- metering
- protection against —lightning
- protection against —overloads
- protection against —short circuits

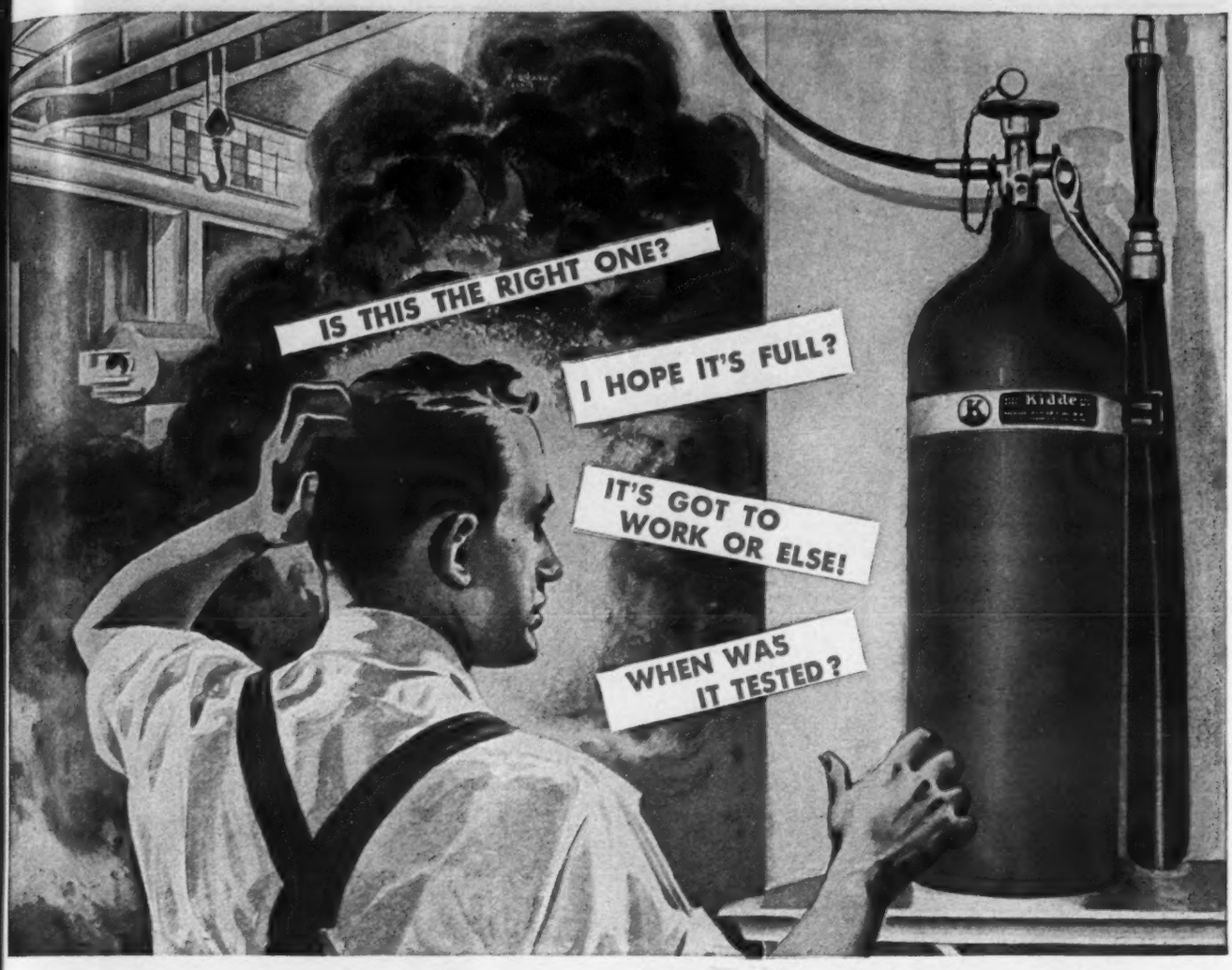
Compare this with the time required to move a conventional single-feeder substation . . . with its 43 major components. The Westinghouse CSP power transformer makes reconversion easy and *economical.* It saves man-hours . . . permits practically 100% salvage of the war-load installation.

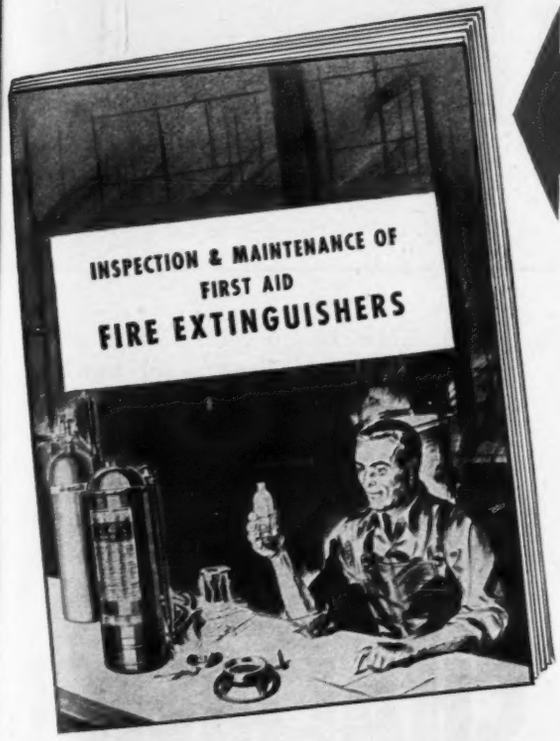
The Westinghouse CSP power transformer performs *all* the functions of a conventional single-feeder substation. It is completely self-protecting (CSP) against lightning, overload and short-circuit damage. For complete information, call your Westinghouse office or write Westinghouse Electric & Manufacturing Company, Dept. 7-N, East Pittsburgh, Pa. J-70430

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

PACKAGED POWER





FREE BOOK tells how to be sure your extinguishers are ready!

Your fire extinguishers are *first aid* equipment. They must be ready to nip fires quickly — and that means they must be in top form *at all times*. Regular inspection is the only sure way to keep them in condition.

The booklet shown here has just been issued by Walter Kidde & Company to help you set up a fire extinguisher maintenance system. It covers all types of equipment, gives *specific* instructions. Write for your copy of this free booklet today!

Kidde

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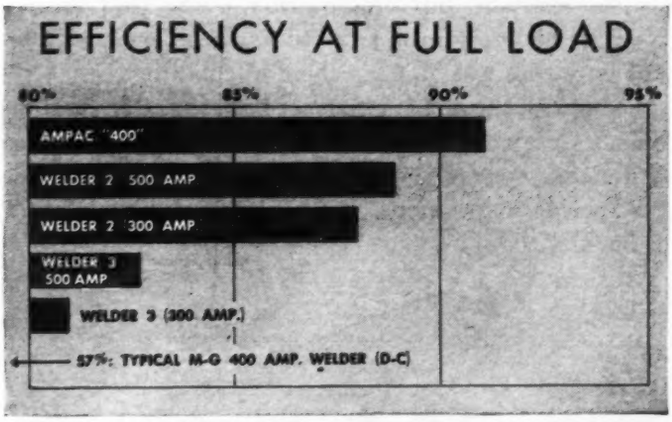

4 High welder efficiency means *decreased* power consumption — and therefore *lower power bills!* Compare Ampac's excellent rating against two largest selling a.c. welders and a typical d.c. unit. You *save* with Ampac! A 1678

GET THE FULL STORY on this great new welder from your nearby Ampac dealer or Allis-Chalmers district office. Learn about its exclusive patented circuit. Ask for bulletin B6302 . . . also B6241 on Ampac "200".

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MILWAUKEE, WISCONSIN

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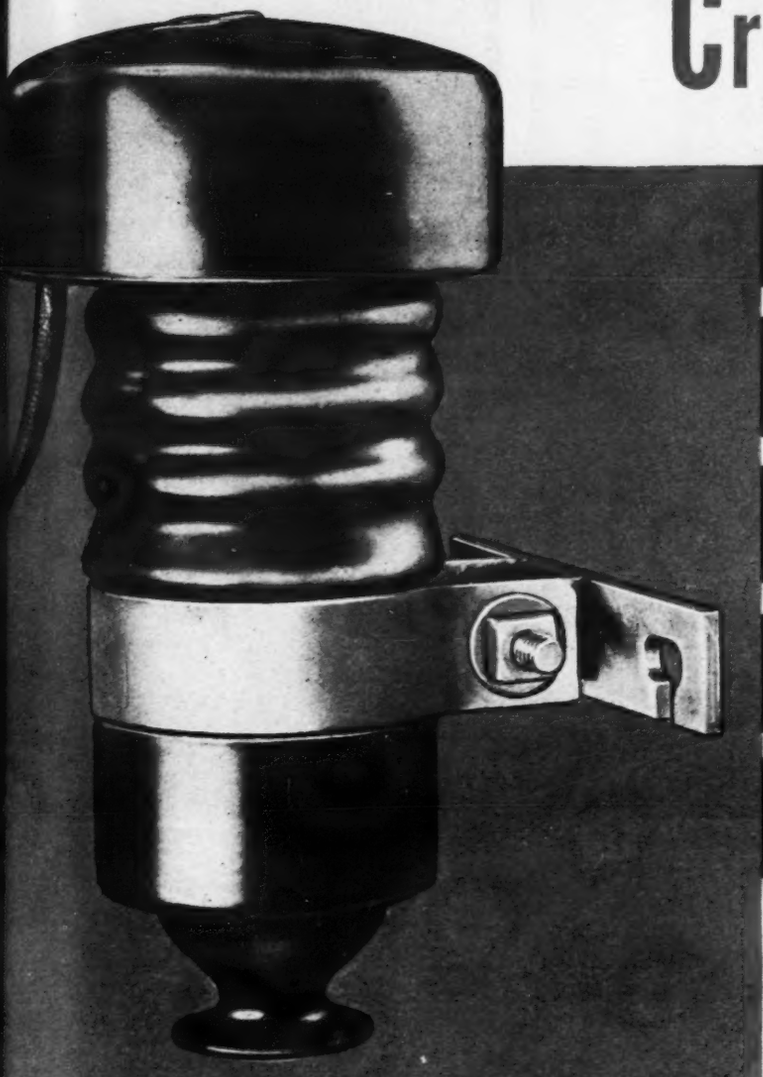
TO EQUIPMENT AND SERVICE IS AFFORDED BY

Crystal Valve's



Typical Crystal Valve Lightning Arrester

- *Heavy Duty* high surge discharge capacity.
- *High Speed* low impulse breakdown voltage.
- *True Valve Action* for follow current interruption.
- *Low IR Drop*—surge voltage reduction.
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LIGHTNING ARRESTERS

Meet Mr. Quality

ONE LOOK AT Bill Seebode — 50 year man at Allis-Chalmers Norwood Works — tells you that he sleeps well nights.

One reason is that he and hundreds of his fellow craftsmen at Allis-Chalmers have won *and are keeping* the confidence of engineers and operating men throughout American Industry.

That means a lot to veterans like Bill who've made a career of building great motors.

Bill's a stator-winder, as you can see—a living example of the truism that *men* make motors.

No machine known can assemble the maze of wiring and insulation that goes into a stator with his skill and care. No machine can fully test how *well* he's done his job.

There's only one test . . . wait 5, 10, 15 years and *see.*

And that's the test that has proved Allis-Chalmers motors are *great* motors. That's why you hear it said so often: *"You can depend on Allis-Chalmers Motors!"*

Yes, hundreds of Allis-Chalmers men—*quality* men like Bill Seebode — know they have a big personal stake in every Allis-Chalmers motor. When they build a great motor for you, they're making a friend . . . and they know that's something no company and its workers can have too many of. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

• • •

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A 1729

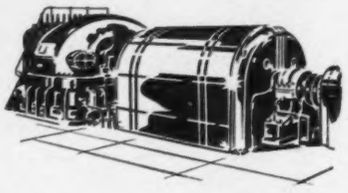
YOU CAN DEPEND ON ALLIS-CHALMERS MOTORS

ANNOUNCING NEW GARGOYLE D.T.E. OIL!

Designed for today's most Severe Turbine Operating Conditions of greatly increased Steam Pressures and Temperatures.

PROVED FAR SUPERIOR!

THE TREMENDOUS PROGRESS made in steam turbine design has resulted in the use of greatly increased steam pressures and temperatures. This increased heat subjects turbine oil to severe oxidation conditions.



To meet these new, severe requirements, Socony-Vacuum has developed a brand-new turbine oil, a great addition to the Gargoyle D.T.E. Oil line.

The base stock of this oil is in itself a high-grade turbine oil having great resistance to oxidation. Further resistance to oxidation plus anti-rust qualities are added to this excellent turbine oil by special processing.

The result is the ideal turbine oil, Gargoyle D.T.E. Oil 797.

This new oil has already proved its superiority. In gruelling tests it surpassed all leading turbine oils in resistance to oxidation.

This oil is in service in turbines ranging in size from 1500 KW. to 50,000 KW. Ask your Socony-Vacuum representative for details.

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HERE'S WHAT MAKES A GREAT TURBINE OIL:

✓ ***Excellent Base Stock:*** The fundamental requirement for an ideal turbine oil is a base stock that in itself is an excellent turbine oil with excellent resistance to oxidation.

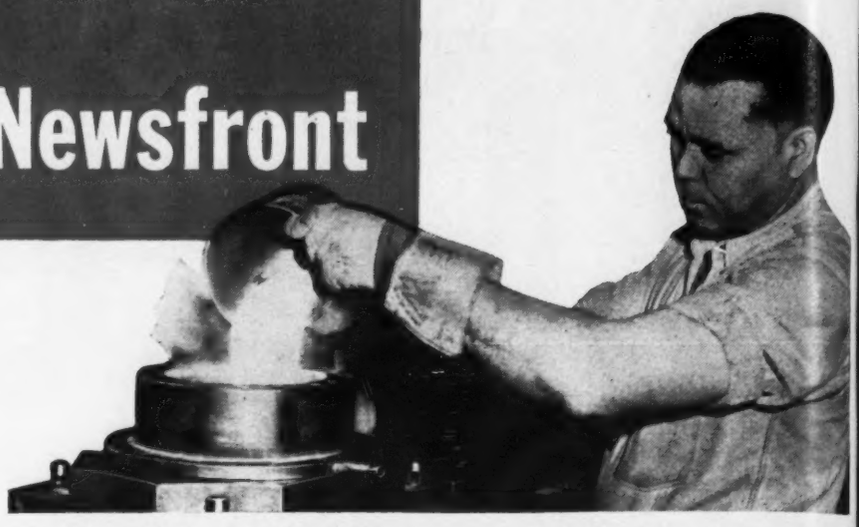
✓ ***Extra Resistance to Oxidation:*** Oxidation protection —PLUS—is needed to meet the effect of greatly increased temperatures in modern turbine operation. Your turbine oil should have this PLUS protection.

✓ ***Maximum Anti-Rust Qualities:*** The possibility of the presence of water demands that the oil should furnish maximum protection against corrosion. Your turbine oil should give this protection.

THE NEW GARGOYLE D. T. E. OIL 797 HAS ALL OF THESE NECESSARY CHARACTERISTICS

FROM THE LEADER IN LUBRICATION: Socony-Vacuum Oil Co., Inc.

Life on the *Plastics* Newsfront

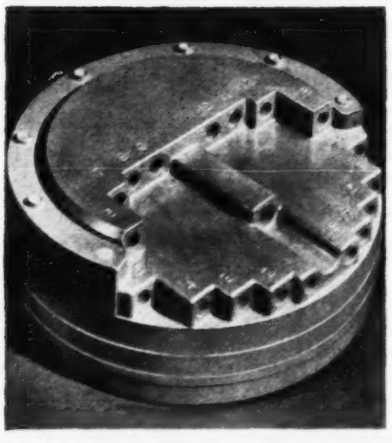


PREHEATED MELMAC* molding powder is measured into the pot to be transfer-molded into a powerfully efficient aircraft distributor head.

(*Above*) **HEAD IS MOLDED COMPLETE** with 26 electrode inserts, shown being placed in the lower half of the mold. Core pins are inserted in upper half to form holes for ignition wires.

(*Above*) **NUMBER MARKERS** are being inserted in holes on the outside of the molded MELMAC head to designate which cylinder is linked with each insert.

(*Above*) **FOUR DISTRIBUTOR FINGERS,** or rotors, are seen in the mold. They are also molded of MELMAC by Ford to be used in connection with the distributor head.



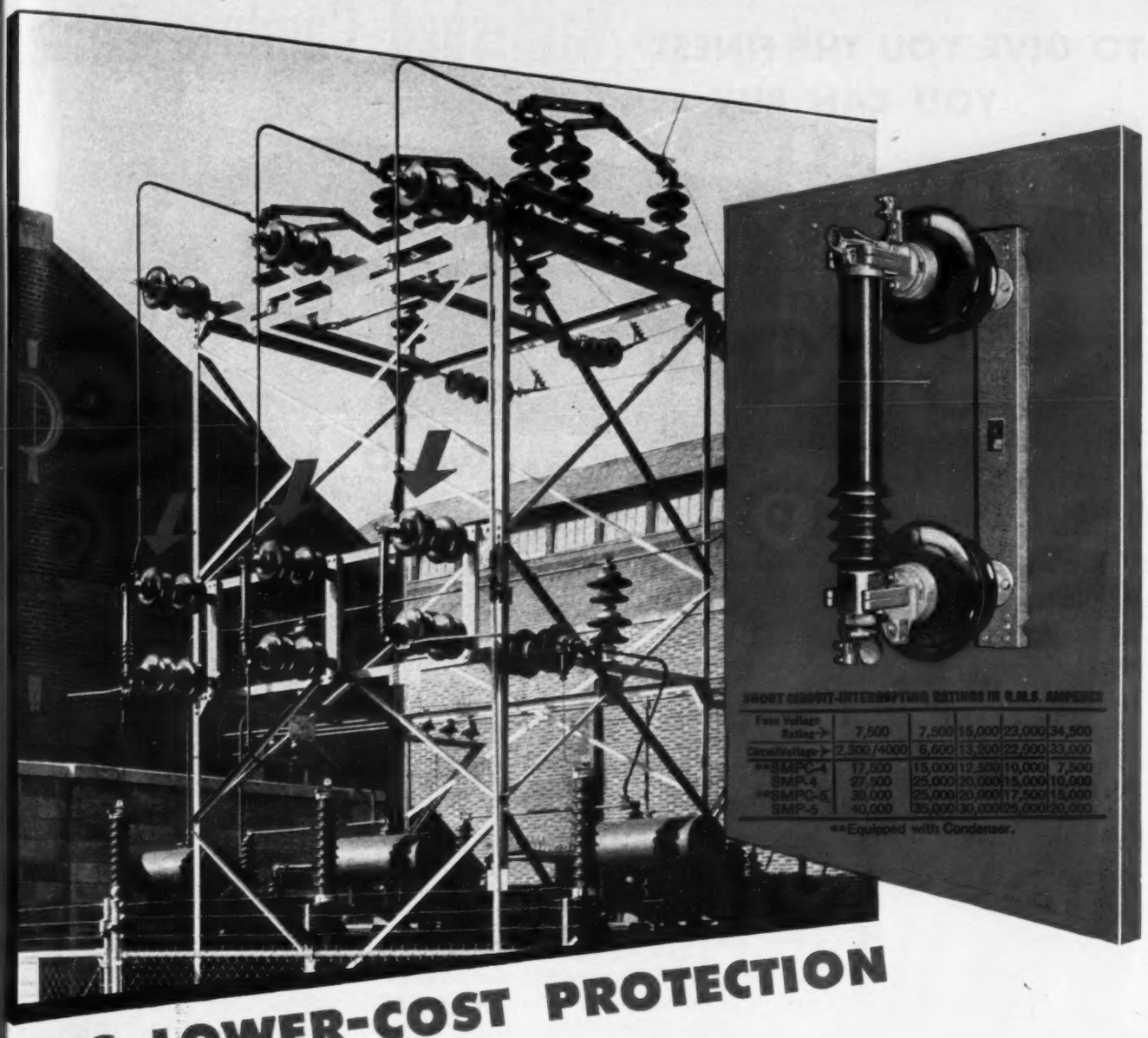
(*Above*) **EACH MELMAC DISTRIBUTOR HEAD** is subjected to a high voltage test in the Ford laboratory before delivery. It must withstand 12,000-volt resistance between each electrode—a voltage that burned or melted heads made of rubber.

MELMAC DISTRIBUTOR HEADS FOR HIGH ALTITUDE FLYING MOLDED BY FORD

Thousands of MELMAC distributor heads are serving in the air attack hammering at the invasion front. These intricately designed plastic parts, molded by the Ford Motor Company of Cyanamid's mineral-filled MELMAC, have unusually high arc resistance, great dielectric strength, high heat and moisture resistance. These same MELMAC properties will be important aids in your postwar manufacture of electrical parts and equipment.

*Reg. U. S. Pat. Off.

AMERICAN CYANAMID COMPANY · PLASTICS DIVISION
30 Rockefeller Plaza, New York 20, N. Y.
CYANAMID PLASTICS
BEETLE · MELMAC · URAC · MELURAC · LAMINAC



SHORT CIRCUIT-INTERRUPTING RATINGS IN R.M.S. AMPERES

Fuse Voltage Rating→	7,500	7,500	15,000	23,000	34,500
Circuit Voltage→	2,300 / 4000	6,600	13,200	22,000	33,000
**SMPC-4	17,500	15,000	12,500	10,000	7,500
SMP-4	27,500	25,000	20,000	15,000	10,000
**SMPC-5	30,000	25,000	20,000	17,500	15,000
SMP-5	40,000	35,000	30,000	25,000	20,000

**Equipped with Condenser.

THIS LOWER-COST PROTECTION

Saves Space, Weight, Structural and Other Critical Materials . . . and is Low in Maintenance Costs

More and more substations are going to this type of protection—specifying S&C type "SM" Power Fuses for their known dependability, uniform accuracy in time-current characteristics and high interrupting capacity. They are rated to 33KV in capacities from 1 to 400 amperes, and are available for indoor or outdoor service. Bulletin 200E gives complete data. It will pay you to send for it.

SCHWEITZER & CONRAD, INC.
4435 Ravenswood Avenue, Chicago 40, U. S. A.
Supplied in Canada through Powerlite Devices, Ltd., Toronto

TYPE "SM"
POWER FUSES
EXPERIENCE CHOOSES S&C FUSES

TO GIVE YOU THE FINEST YOU CAN BUY . . . Varnished Cambric Cables

. . . THIS IS WHAT WE DO

1. In our well-equipped research and testing laboratories, the varnished cambric is tested for resistance to the effect of hot oil and solvents.
2. The cambric tape is critically examined for gauge, thread count and tearing strength.
3. Precisely controlled ovens subject it to aging tests far in excess of normal requirements.
4. Samples from each lot are tested for dielectric strength under carefully controlled conditions.
5. And finally, experienced operators apply these improved tapes to the cable, using newly designed equipment that insures proper tension, correct angle of application, and positive control of tape position.

THREE-CONDUCTOR
VARNISHED CAMBRIC CABLE
LEAD SHEATHED
SHIELDED TYPE

THE war has made it necessary for Varnished Cambric Cables to handle much of the load formerly carried by rubber. These cables have been substantially improved to meet more exacting performance requirements.

Higher resistance to heating and aging now permits the cables to carry heavier loads for longer periods. The development of stronger tapes and tougher varnishes provides greater resistance to mechanical abuse and to the action of solvents on the varnished film. More precise methods of application of the tape to the conductor insure more uniform mechanical and electrical properties throughout the cable.

Why not take advantage of the reliability and long-lived performance that these improved Varnished Cambric Cables offer?

Whether you need low voltage wire or high voltage power cables up to 15,000 volt rating (that embody the latest discoveries in shielded cable with PS semi-conducting tapes to eliminate corona formation)—or even a 50,000 volt precipitator lead—there is a type ideally suited to your requirements. Catalog on request.

AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago, and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

USS

UNITED STATES STEEL

THE COST OF
Tomorrow's Peace

Today peace-loving Americans are united with thirty-three other nations in a common objective of destruction.

Millions of our fine, young men and women find themselves invading foreign lands in order that their own shores may be spared, and their free way of life preserved.

Their sacrifices will be great. Their job will be well done.

But what of the job they will expect of us when they have finished theirs . . . the job of turning their hard-won victory into a lasting pattern of peace?

Can we come up to their great expectation? We must realize that this is the last opportunity of our generation. We must do a better job of it than we did in the Twenties and the Thirties.

We have our backs to the wall, and the scars of World War I and a thirteen-year depression still are upon us. The final test of our way of life is at hand!

As we look over our shoulder into the immediate past, we see little to encourage us. But we also see much to make us pause. We see a tremendous fighting machine, created in a matter of months by the miraculous organization of our resources.

We, the largest of the peace-loving nations, have overnight become masters at the business of waging war. Today, as a result of the coordination of industry, labor, and government, we are producing ***for war alone*** as much as our total normal production for peace.

* * *

We have amply demonstrated our ability to harness the vast productive capacity we possess. Why cannot these resources, which we have organized so efficiently for the destruction of life and property, be directed toward the destruction of the causes of war?

May not the patriotic and emotional strength and the unity of action which have been stimulated for the purpose of winning the war be directed, at least equally well, toward the attainment of world peace and international harmony?

If they are not so directed, what lies ahead but another war? And how can America, in a world that is so rapidly shrinking in size, avoid involvement in ***any*** of tomorrow's conflicts?

International peace is an ambitious dream and its price is high, but the price of war is even higher. Our world cannot long survive the periodic waste of its human and material resources.

Our country can be the most potent single force in bringing about the international understanding that leads to peace, in developing the unity that will make the most of the ample resources nature has provided everywhere.

* * *

There is no unity in selfishness. There can be no unity if any one of the great powers fails to do its part in determining and eliminating from the world the basic causes of aggression.

These basic causes stem from greed and the suppression of opportunity for individual progress; for self-preservation is the first law of nature.

Mussolini's dramatic march on Rome in 1922 was made possible by disillusioned veterans of World War I who could find no jobs and whose future held no promise. Some of Hitler's most

determined followers came from the same ranks.

Men denied the opportunity to make a living, for themselves and for their children, are easy prey to false doctrines and dangerous "isms."

In any realistic appraisal of our domestic problems—economic, labor, racial—it is clear that we can solve them, not by waiting until we reach some utopian accord, but by making a series of compromises. We do this because we know how discord can impair the very roots of private enterprise, self-government, and self-discipline—the essentials of a dynamic democracy.

Similarly, peaceful reconstruction of our world economy depends on the ability of nations to reconcile their differences in a series of working agreements.

If we in the United States want lasting peace and if we want to preserve our democratic way of life, we must take over our full share of the task of initiating these compromise measures. Acknowledging our inescapable responsibility as the greatest economic and military power in the world, we must attempt to insure the free flow of world trade, and develop—with profit for both parties—backward areas abroad as well as at home. And we must do this by making all nations share the responsibility, not by allowing ourselves to be manoeuvered into being an international Santa Claus.

With our allies, we will have to see to it that the devastated portions of the world rehabilitate themselves as quickly as possible; that practicable and realistic trade and economic relations between nations are developed; and that the energies and productive capacities of these nations are set free to function in a climate that is favorable to the growth of free enterprise and individual initiative. As the most powerful economic force on earth, we have the most to gain and the most to lose at the peace table; and we must never forget that with our power comes responsibility.

We cannot hope to solve all of the problems of all nations—nor even all of our own—but our way can become the way for more of the world's humanity. Our strength can become the guiding spirit of the smaller nations.

* * *

In the development of a sound American foreign policy, let us take care not to attempt to control the destinies of other nations. Let us remember that we must set the example of self-determination of independent, free peoples.

Freedom is essential to international peace; and free competition—whether it be between individuals, between businesses, or between nations—is the mainspring, the synchronizer, and the preserver of freedom. For competition always is synonymous with private enterprise.

We are not a covetous nation. We have no territorial ambitions. Our international commercial aspirations are dominated by the conviction that we have a great stake in world unity and world prosperity. We know that we can no longer live apart from other nations and that we cannot ignore the fundamental elements which affect the well-being of other countries.

Our foreign policy must encompass a world of trade, and help develop it.

We dare not blunder in the execution of that foreign policy if the American way of life is to survive. A democracy resolved upon isolation is doomed in the world of tomorrow.

Let us resolve that out of this devastating catastrophe we shall emerge with fuller understanding and greater determination to build the kind of world which can materialize only if this country has the vision and the will to see it through.

We still are free to decide our own fate—still free to shape our own future. We still are free to preserve the liberty and happiness that has made our country the hope of the world.

President, McGraw-Hill Publishing Company, Inc.

The ONE difference in O-B switch and bus insulators that makes ALL the difference

● There's no difference between O-B and all the other switch and bus insulators except in one respect--and that makes *all the difference!*..You can specify an insulator's dimensions and how it will test when new, but you can't specify what a company must know about insulators in general, or how diligently it applies that knowledge of insulation, nor can you specify the ultimate outcome of this knowledge in terms of operating performance for the next 25 or 30 years...These are intangibles that defy any kind of definition. They depend entirely upon individual men's skill and experience...Proof that these are not mere words comes from countless operating records that date back 25 to 30 years--the oldest in the industry--and show the stamina of O-B. These records cover thousands of units and form the soundest basis for today's purchases...To be sure of being right many years from now, buy O-B insulators today!

Ohio Brass

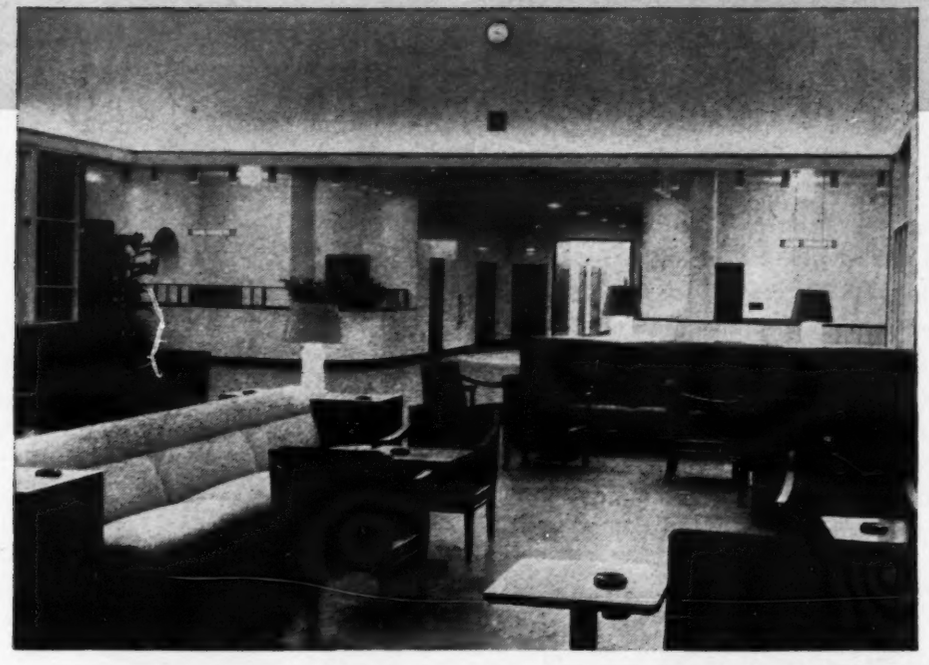
MANSFIELD, OHIO

CANADIAN OHIO BRASS COMPANY, LIMITED,
NIAGARA FALLS, ONTARIO

2478-H

Do you know that there are two kinds of

Fluorescent Lighting?



• For Better Light—Longer Life—Use ZEON Cold Cathode, Fluorescent Lighting.

- **LONGER LAMP LIFE**
- **LOWER MAINTENANCE COST**
- **INSTANT STARTING**
- **CONSTANT LIGHT FLOW**
- **LESS HEAT**
- **LESS GLARE**
- **FEWER AUXILIARIES**
- **GREATER FLEXIBILITY**

FEDERAL ELECTRIC

ZEON

COLD CATHODE

FLUORESCENT LIGHTING

CHANCES are you thought all fluorescent lighting was the same, but lighting engineers will tell you there are two basic types—"Hot" and "Cold Cathode." Of the two, "Cold Cathode" is the latest and a most important development because it brings to fluorescent lighting an entirely new conception of performance, economy and flexibility.

ZEON, the outstanding example of Cold Cathode Fluorescent Lighting, is a development of Federal Electric Company, Inc., who for over fifteen years have been leaders in the field of gaseous discharge lamps.

The great number of successful industrial and commercial installations have established the high efficiency of this unusual light source. Higher levels of illumination at lower cost—lamp life averaging 10,000 hours or more—flexibility of any size, shape, or design of installation—are a few of the features that have made ZEON the choice of wise fluorescent lighting buyers.

Learn more of this better light source before you make a decision on any fluorescent lighting installation. Let experienced Federal Electric engineers work out your lighting problems with you. Their services are available for the asking.

LIGHTING DIVISION

FEDERAL ELECTRIC COMPANY, INC.

1700 SOUTH STATE STREET, CHICAGO (19), ILLINOIS • TELEPHONE VINCENNES 5300

Branch Offices: Cincinnati • Houston • Louisville • New Orleans • Dallas • Indianapolis
Milwaukee • New York • Duluth • Kansas City • Minneapolis • Philadelphia

Subsidiary Company: Federal Brilliant Company, St. Louis, Missouri

★ BETTER WIRING FOR BETTER LIVING ★

Where was Mary when the lights went out?

THIS month we bring you another touching episode in the history of the Bjones family—who built a dream home, only to have it turn into a nightmare.

Upstairs, Mr. Bjones is entertaining (?) his boss—trying to make light conversation in a house as *dark and dismal* as Schickelgruber's future.

And where is Mary Bjones? Alas, she's down in the cellar fussing and fumbling with fuses—*wondering why life is just one darn fuse after another!*

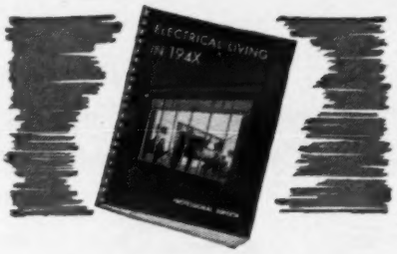
There are three reasons for the trials and tribulations of Mr. and Mrs. B . . .

First—their home was *inadequately wired* to carry the electrical loads imposed by modern lighting and electrical appliances.

Second—their home was not equipped with *modern circuit protection*—they could not restore electric service, at the flip of a switch, after the trouble was corrected.

Third—their home did not have modern circuit protection—*conveniently located*—they had to go to the "hard to get to" protective device in the cellar.

We have prepared a new book—"Electrical Living in 194X"—that will help you explain the urgent need for *better wiring* and *modern protection* to present and future home owners.



"Electrical Living in 194X" tells all about increased electrical loads in future homes—modern circuit protection—lighting and lighting controls—entrance equipment and distribution panels.

This big, profusely illustrated, 64-page book is free! Get your copy now, by writing Better Homes Department (EW-64), Westinghouse Electric & Manufacturing Company, Pittsburgh 30, Pa.

BETTER HOMES DEPARTMENT

Six Point Advisory Service

. . . offers free technical advice on the selection, application, and arrangement of fixed electrical equipment in 194X homes—dimensions and clearances, for proper installation and easy access for servicing—placing of lighting outlets and controls—location and size of wiring, water supply, and drainage lines.

Send your electrical problems to the Westinghouse Better Homes Department. Our housing specialists will give you authoritative information, promptly.

Westinghouse

Plants in 25 Cities ***Offices Everywhere***

WESTINGHOUSE PRESENTS *John Charles Thomas, Sunday, 2:30 p.m., E.W.T., NBC*
"Top of the Evening", Monday, Wednesday, Friday, 10:15 p.m., E.W.T., Blue Network

WaterFOG

HELPED NAVY SAVE BLAZING TRANSPORT "WAKEFIELD"

Flown 1,000 miles to perform the greatest fire-fighting achievement in the history of the sea . . 150 miles off the Canadian Coast . . . Rockwood WaterFOG equipment helped eight Navy firemen subdue a fire that had been raging for 30 hours on the transport U. S. S. Wakefield (former "Manhattan"). Thus our second largest transport, seemingly doomed to certain destruction, was saved for further service.

Navy, Coast Guard, Maritime Commission and Army and hundreds of industrial plants rely on WaterFOG equipment—fixed piping or hose nozzles—to put out oil fires fast. For WaterFOG is man-made fog . . . water broken up into tiny particles by impinging streams of water from specially-designed Rockwood nozzles.

Its fire-fighting principle is simple . . . speed of heat absorption increases with surface area exposed to heat. Rockwood nozzles multiply many times the total surface area of a given volume of water, giving it capacity to cool fires faster. Furthermore, WaterFOG drifts over the liquid (instead of plunging into it), thereby retarding vaporization. Finally, it becomes steam, shutting off air. Thus, it cools, confines, starves the fire.

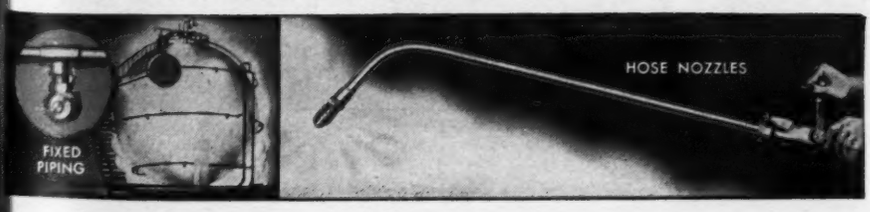
With WaterFOG, less water is needed, saving water and water damage. "Flash-back" is prevented. Electrical fires are controlled with minimum of damage. Rockwood-engineered installations are approved by Underwriters' Laboratories and Associated Factory Mutuals.

Write today for Bulletin 123.

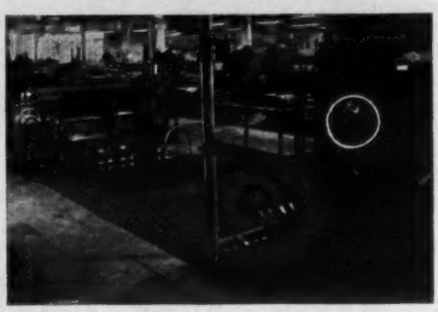
ROCKWOOD SPRINKLER COMPANY
62 Harlow Street, Worcester 5, Mass.
Specialists in Fire Protection Engineering, Equipment and Installation since 1907

ROCKWOOD WaterFOG

Water Engineered by Rockwood Cools, Confines, Smothers Oil Fires



Oil Fire in Shell Plant Nipped by WaterFOG



Under the grating is a 4000-gallon quench tank. Shell casings leaving the hardening furnace are immersed in the oil before reaching the conveyor at the right.

When the oil in that tank caught fire, it took only 9 seconds for WaterFOG to put it out!

The only damage was blistered paint on wood post near the discharge end of the furnace. The quench tank was back in operation shortly after.

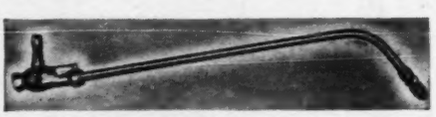
One of the WaterFOG heads is shown circled. It is protected by a blow-off cap. Each of the heads is connected by fixed piping to a Deluge Valve which supplies water upon the automatic detection of fire.

On this and many other oil fire hazards, a WaterFOG system of fixed piping, heads, valves, and automatic controls has proved to be the most efficient form of fire protection. Because the spacing of heads, distance between heads and hazard, and other factors are important in determining correct particle size, fog pattern, and velocity, it is recommended that WaterFOG systems be installed by ROCKWOOD engineers (authorities on hydraulics as applied to fire protection).

Typical WaterFOG Applications

- transformers
- oil switches
- generators
- paint shops
- oil storage
- regulators

etc.



Portable WaterFOG Equipment for Regular Fire Hose Lines

The photograph shows Rockwood's SG-40 Nozzle equipped with extension applicator which discharges low-velocity WaterFOG in ball shape.

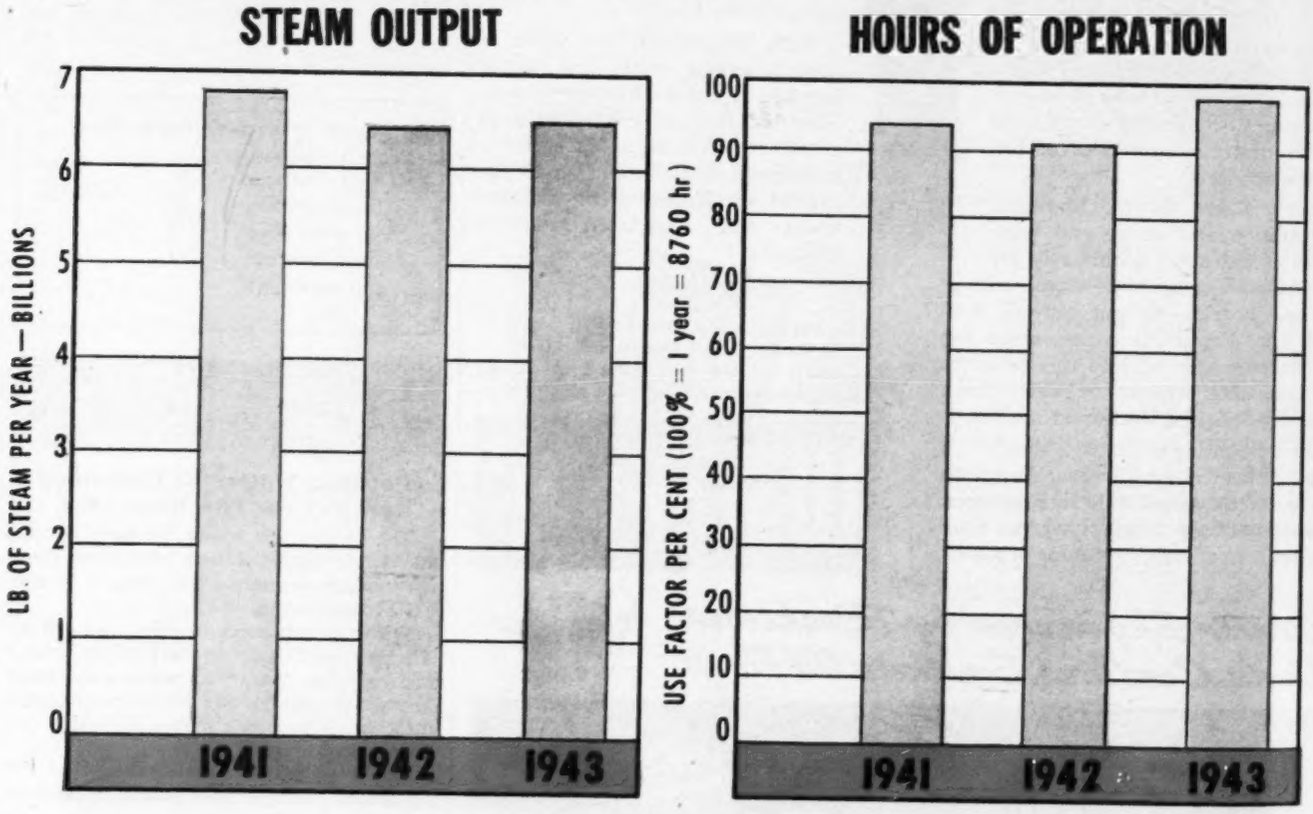
With the applicator removed and a FOG Tip inserted, this nozzle will discharge either high-velocity WaterFOG with considerable forward projection, or a straight stream for attacking inaccessible places or rooting out deep-seated fires.

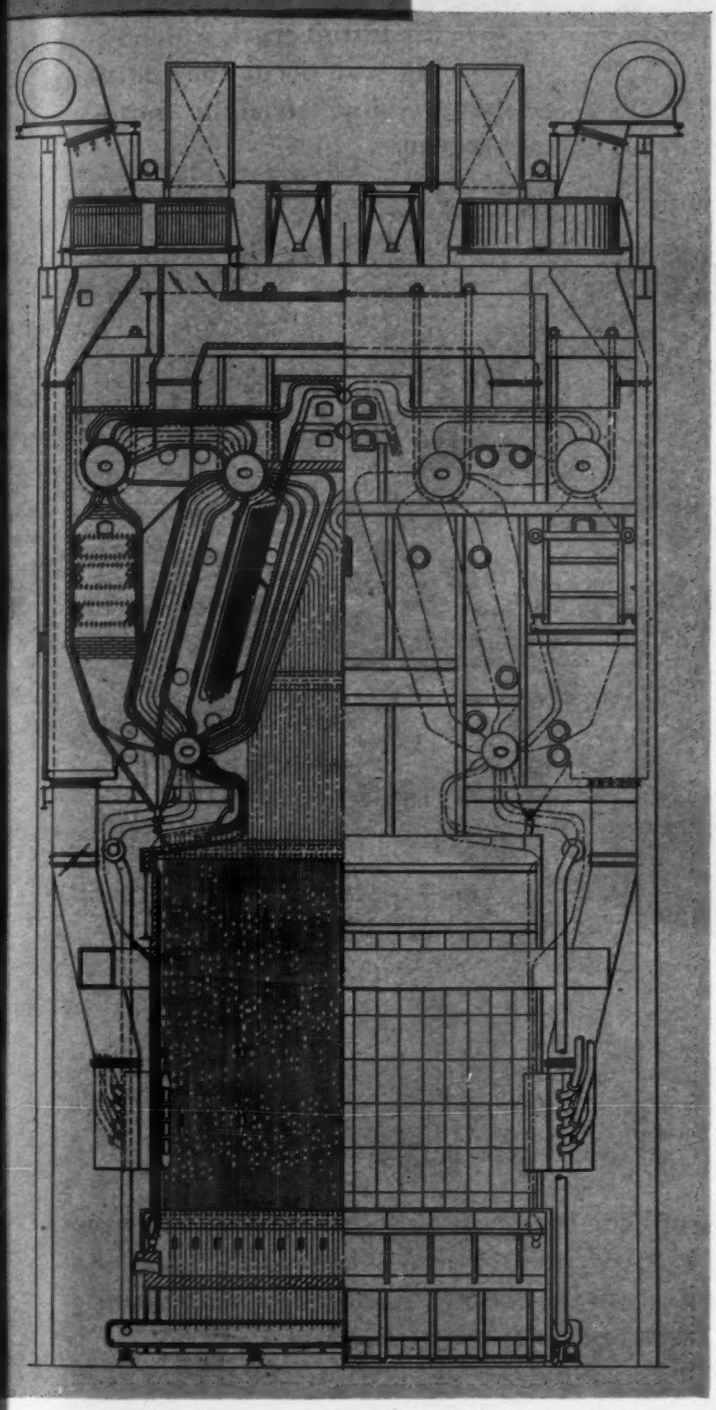
The 1½" SG-40 Nozzle takes 4' or 10' applicator; the 2½" size takes 12' applicator.

EXECUTIVES: A colored movie (16 mm.) showing tests of Rockwood WaterFOG is available.

In 3 YEARS of war-time service this C-E Steam Generating Unit was "on the line" 94.3% of all the time producing nearly 20,000,000,000 lb of steam

(an average of 800,000 lb per hour)





C-E Steam Generating Unit, installed in 1937 by a large Eastern utility. Designed to produce 1,000,000 lb of steam per hr at 1340 psi and 925 F. Serves 1 — 40,000-kw high-pressure turbo-generator and 5 — low-pressure units with a combined output of 50,400-kw — an aggregate of 90,400-kw.

BETTER than words can describe, the two charts on the left page covering

1. steam output
2. use factor

quickly tell the complete story of the exceptional performance of an exceptional C-E steam generating unit, during the past three years.

Such reliable operation and high steam output have contributed importantly to our national war effort. For this big C-E unit is installed in a power plant of a utility system that serves many war factories and also one of the country's largest coal mining areas where it is producing the power needed to mine this critical material upon which so much other war production must rely.

This is another outstanding example of how effectively the public utilities of the United States are meeting the challenge of our wartime emergency. It is also another example of the exceptional performance qualities built into all Combustion Engineering equipment.

A-801

C-E

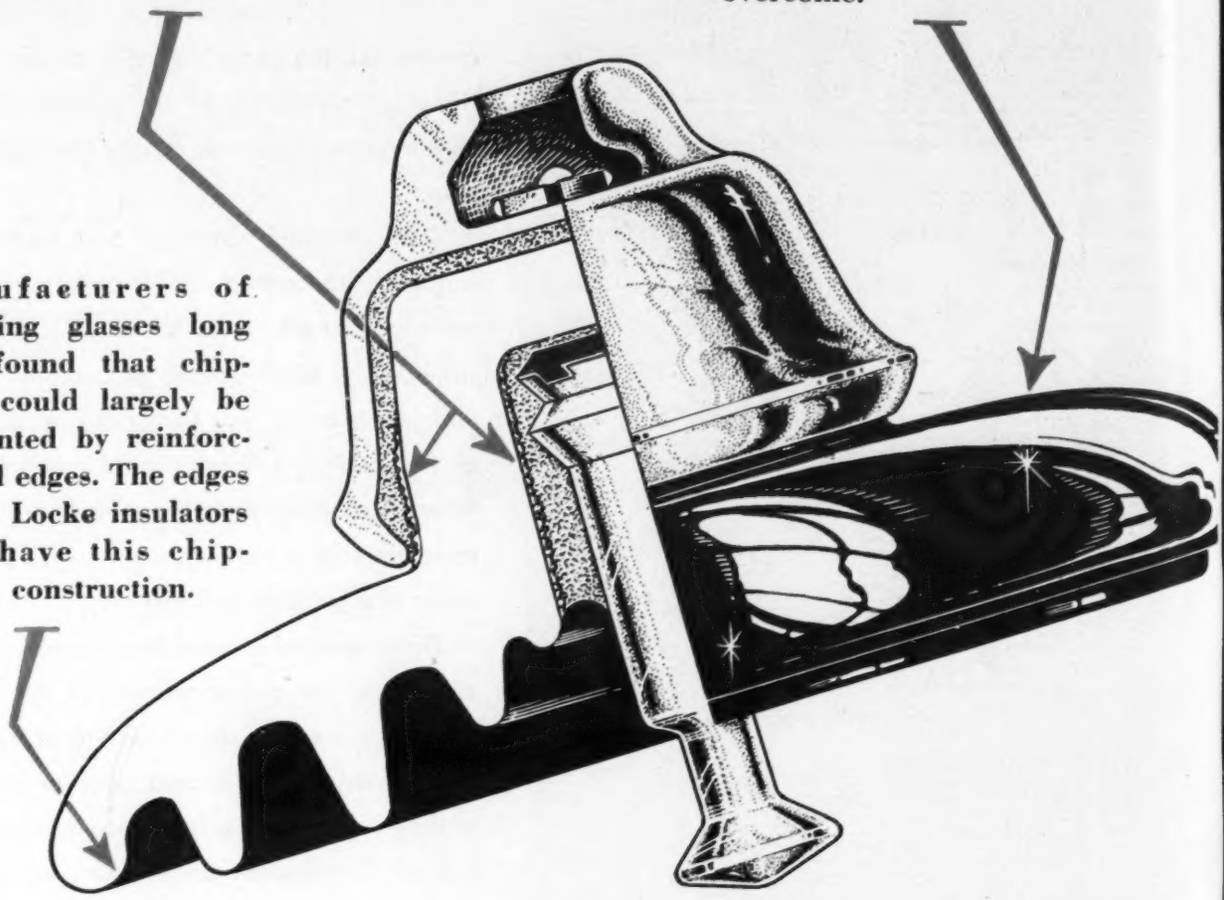
COMBUSTION ENGINEERING

200 MADISON AVENUE, NEW YORK 16, N.Y.

How

Even compression glazed insulators can be materially weakened when these surfaces are treated with ordinary "sands". Locke compression sand, on the contrary, makes these working zones the strongest part of the assembly.

The entire surface of every Locke insulator is in compression. Before the initial crack which causes breakage can occur the additional compression strength must be overcome.



Manufacturers of drinking glasses long ago found that chipping could largely be prevented by reinforcing all edges. The edges of all Locke insulators also have this chipproof construction.

These Proved Benefits . . .

reduce upkeep—spread the initial costs of your insulators over more years—and enable your construction crews to handle installation and replacements faster and with greater safety.

ORIGINATOR AND LARGEST MANUFACTURER OF WET-PROCESS PORCELAIN INSULATORS

LOCKE INSULATOR

FIRST IN CLAYRAMICS

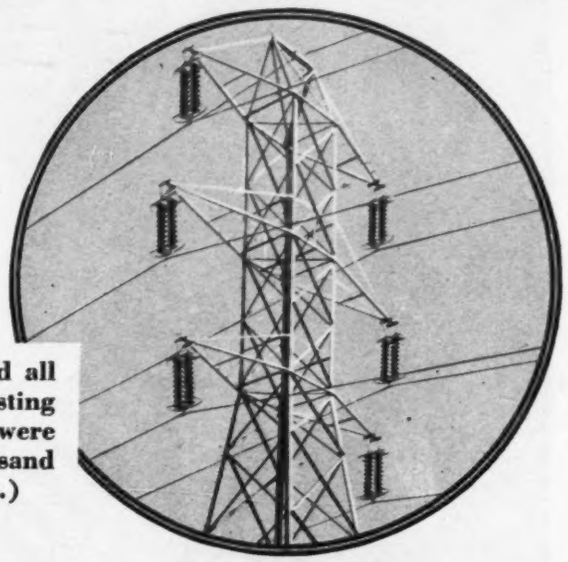
good IS that insulator ?

Yes, it passed all the standard tests with flying colors. Maybe it will also stand the test of time.

But are you sure?

As the oldest and largest manufacturer of wet process porcelain insulators, we have had much to do with establishing standard acceptance test procedures. But even we cannot say that insulators which satisfactorily meet these tests will equally well meet your service requirements.

What we can, and do say, is that Locke designs, embodying among others the features listed here—made by the exactly controlled methods peculiar to Locke—not only meet laboratory tests but have also established better performance records in service.



An operating engineer says—"Originally we tested all insulators annually. After several years of testing Locke insulators with none testing bad, tests were stopped." (This involves several hundred thousand Locke suspension insulators installed since 1924.)

√ LONGER LIFE IN SERVICE **√ MORE UNIFORM STRENGTH**

√ LOWER MAINTENANCE AND REPLACEMENT COSTS

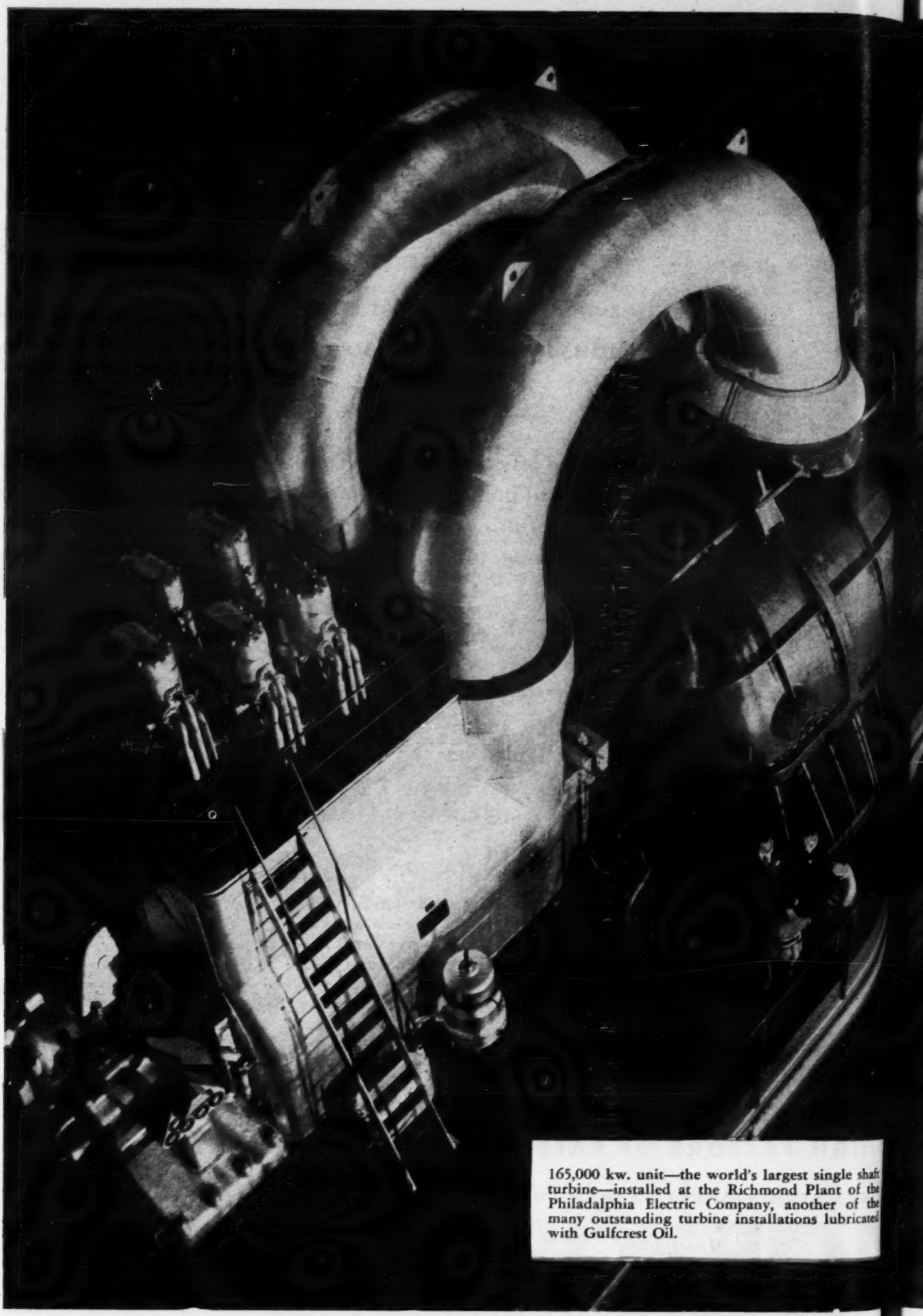
√ HIGH FACTORS OF SAFETY **√ GREATER STABILITY**

FIFTY PROGRESSIVE YEARS OF SERVICE TO THE ELECTRICAL INDUSTRY

LOCKE CORPORATION

BALTIMORE MARYLAND

FIRST IN CLAYRAMICS



165,000 kw. unit—the world's largest single shaft turbine—installed at the Richmond Plant of the Philadalphia Electric Company, another of the many outstanding turbine installations lubricated with Gulfcrest Oil.

WORLD'S LARGEST SINGLE SHAFT TURBINE

makes outstanding record

with Gulfcrest Oil

50,000 HOURS with no evidence of deterioration, and very little make-up—that's the service record of Gulfcrest Oil in this 165,000 kw. turbine installed at the Richmond Plant of the Philadelphia Electric Company, Philadelphia, Pa.

Here's the important reason for the outstanding performance of Gulfcrest Oil in the turbine systems of hundreds of leading power plants throughout the country: More thorough and more complete refining! For in addition to conventional refining methods, Gulfcrest Oil is super-refined by the Gulf Alchlor Process, the most effective method for producing a turbine oil with maximum resistance to oxidation and sludge. Gulfcrest Oil is the world's finest turbine lubricant!

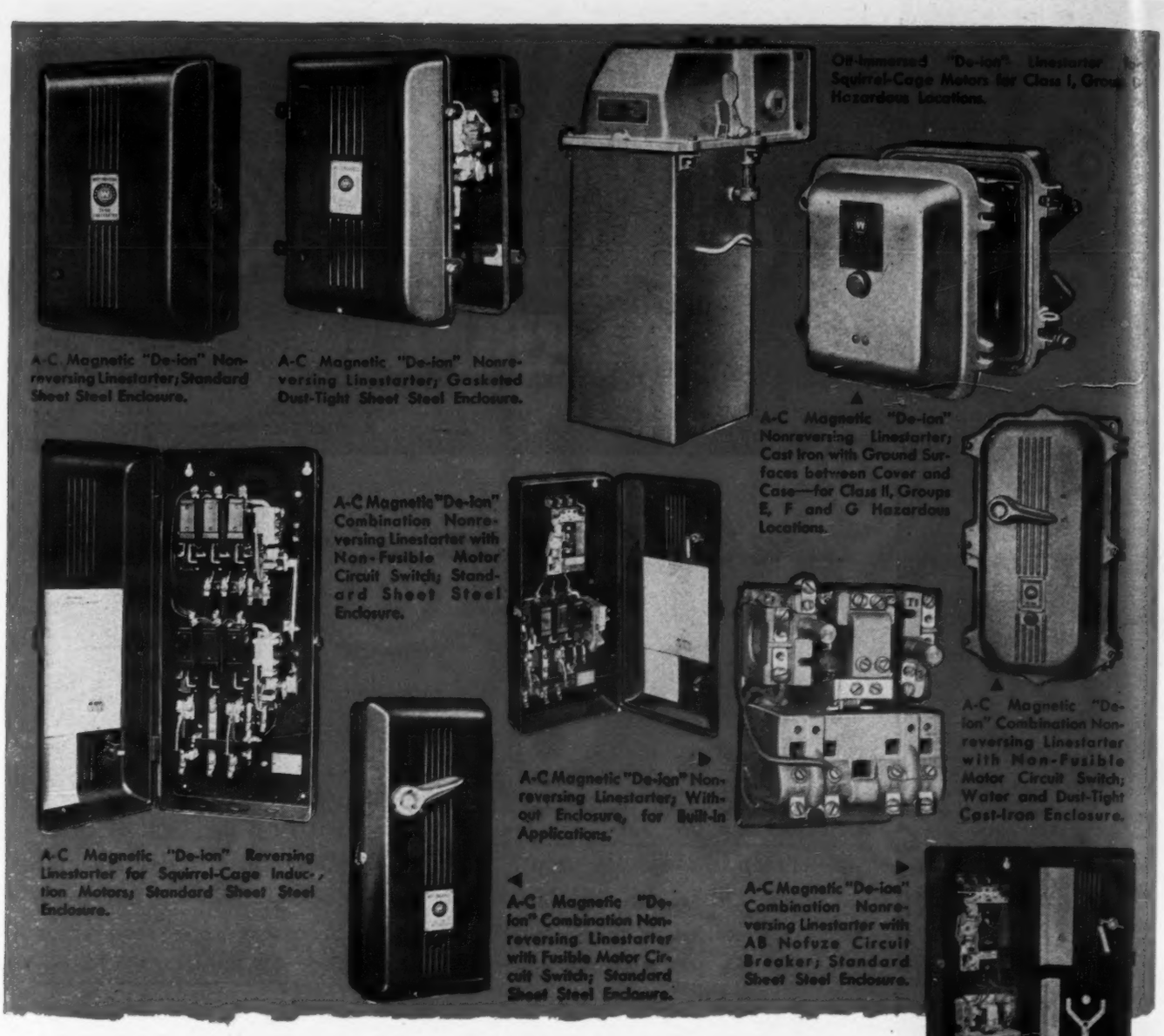
Call in a Gulf Lubrication Service Engineer and ask him to show you how Gulfcrest Oil can help you get improved lubrication and higher operating efficiency for your turbines. Write, wire, or phone your nearest Gulf office today.

Gulf Oil Corporation · Gulf Refining Company

Gulf Building, Pittsburgh 30, Pa.

GULF INDUSTRIAL LUBRICATION

Back the Attack...
Buy More War Bonds!


A-C Magnetic "De-ion" Nonreversing Linestarter; Standard Sheet Steel Enclosure.
A-C Magnetic "De-ion" Nonreversing Linestarter; Gasketed Dust-Tight Sheet Steel Enclosure.
Oil-Immersed "De-ion" Linestarter for Squirrel-Cage Motors for Class I, Group D Hazardous Locations.
A-C Magnetic "De-ion" Nonreversing Linestarter; Cast Iron with Ground Surfaces between Cover and Case—for Class II, Groups E, F and G Hazardous Locations.
A-C Magnetic "De-ion" Combination Nonreversing Linestarter with Non-Fusible Motor Circuit Switch; Standard Sheet Steel Enclosure.
A-C Magnetic "De-ion" Nonreversing Linestarter; Without Enclosure, for Built-In Applications.
A-C Magnetic "De-ion" Combination Nonreversing Linestarter with Non-Fusible Motor Circuit Switch; Water and Dust-Tight Cast-Iron Enclosure.
A-C Magnetic "De-ion" Reversing Linestarter for Squirrel-Cage Induction Motors; Standard Sheet Steel Enclosure.
A-C Magnetic "De-ion" Combination Nonreversing Linestarter with Fusible Motor Circuit Switch; Standard Sheet Steel Enclosure.
A-C Magnetic "De-ion" Combination Nonreversing Linestarter with AB Nofuze Circuit Breaker; Standard Sheet Steel Enclosure.

WHEN YOU NEED *Magnetic Controls*

FOR SINGLE-PHASE AND SQUIRREL-CAGE MOTORS CONSULT WESTINGHOUSE BUYING DATA (NEW CATALOG 7000)

With the new Westinghouse Buying Data, you can select and purchase the proper motor control in half the time.

Data, as presented, is striking in its newness. It's easier to read, easier to understand, and easier to use than any published previously by any manufacturer.

Chances are—if you are a buyer of motors and controls—that you have already received a copy of this new Catalog 7000 by mail. However, if you have not received your copy, write, wire or phone your nearest Westinghouse district office. (Requests will be filled through district offices only — no mailing from Westinghouse headquarters at East Pittsburgh.) J-60552

Westinghouse
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

De-ion Linestarters

Your Peacetime Profits may be Measured in *Kilowatts!*

Your competitors are realizing today that there's many a potential dollar of postwar profits hidden in proper power distribution within their plants. In line with their efforts to cut costs in every direction, they are looking twice at old systems of power distribution, considering ways to make electricity available more dependably, efficiently, and economically to all the places where it will do its work.

Right in your town are men who will help you plan along the same line. Let them start now. You'll be glad you did—later.

Another Way Your Power Company's Engineers Can Help Cut Postwar Costs

YOUR POWER COMPANY'S power engineers know the latest in plant distribution. In fact, utilities themselves have lived through many of the problems you will encounter for the first time, if you plan to change to a more modern distribution system. They have worked these problems out, and have the solutions ready for your use . . . as well as the figures on what better distribution can mean in dollars and cents.

When the time comes to modernize your distribution, remember Roebling as *wire specialists*, a logical source of supply for the wires and cables you'll need for all modernization: better lighting . . . air conditioning . . . power distribution . . . full utilization of the electric and electronic cost-cutters the war has produced.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities

ROEBLING
PACEMAKER IN WIRE PROUCTS

Wire Rope and Strand • Fittings • Cold Rolled Strip • Aircord, Swaged Terminals and Assemblies • Round and Shaped Wire Wire Cloth and Netting • High and Low Carbon Acid and Basic Open Hearth Steels Suspension Bridges and Cables • Electrical Wires and Cables • Aerial Wire Rope Systems

40,000 INDUSTRIAL EXECUTIVES ARE REFERRED TO THEIR LOCAL POWER ENGINEERS for help in planning better postwar use of electricity, by this current advertising of Roebling Electric Wires and Cables in "Mill & Factory" and "Purchasing". We hope that this advertising will result in desirable postwar loads for your company.

Full size reprints of the advertisement available on request

(2103) 33

The 8200 Series

For all generally used ground wire cables.

This drop forged trunnion type ground wire suspension clamp combines strength and adequate cable-supporting length with lightness and smooth contact surface. The integrally forged U-Bolt Keeper on which the supporting bail is factory assembled results in a minimum of loose parts and simplicity of field application.

Why not get the full story on BTC clamps. Your copy of our Hi-Line reference book on request.

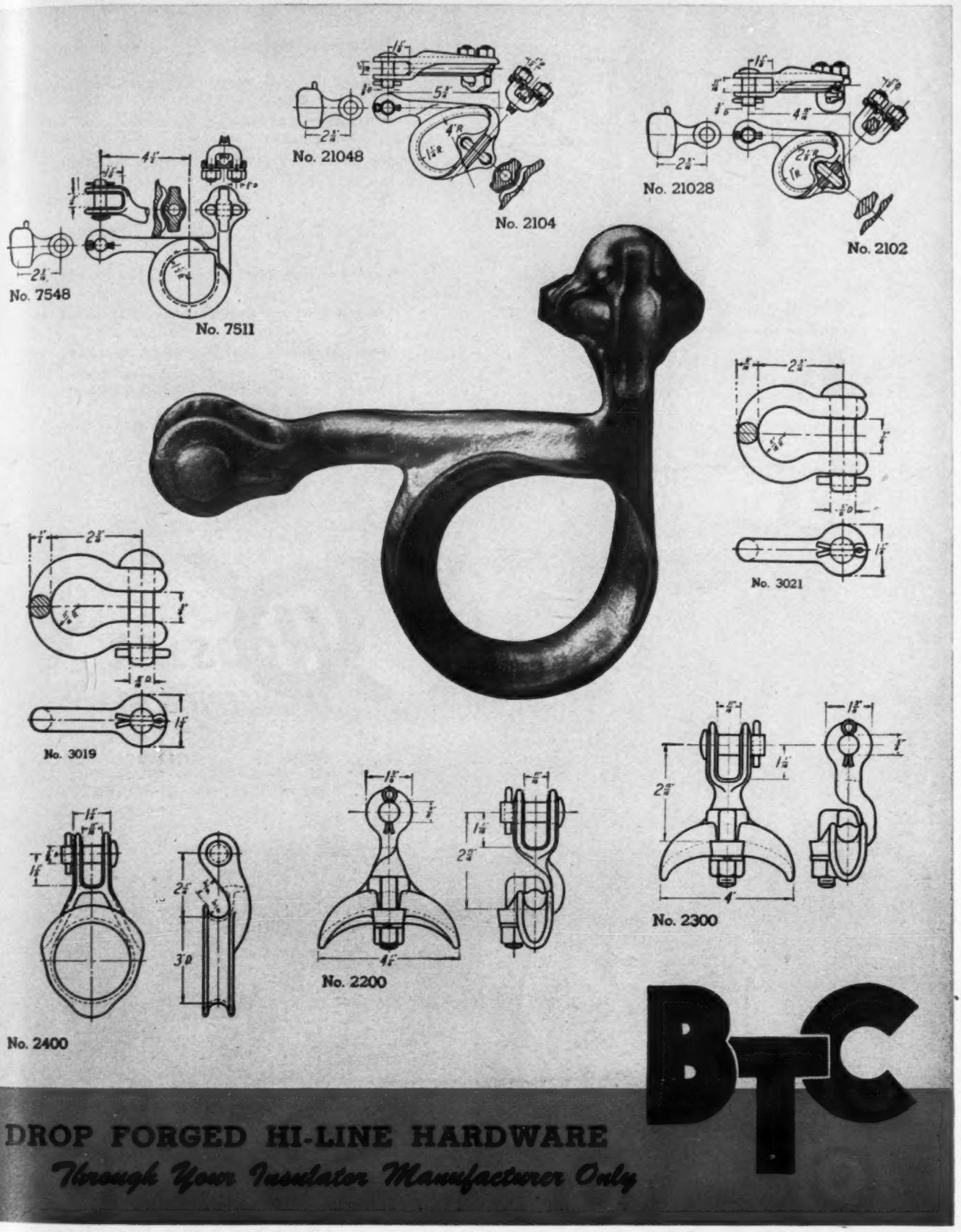
Through Your Insulator Manufacturer Only

BTC

Drop Forged Hi-Line Hardware

THE BREWER-TITCHENER CORPORATION

The use of forged steel results in light weight with more than adequate strength. Low in price, this hardware is especially adapted to rural electrification and light transmission work. Catalog covering line of clamps and hardware sent on request.



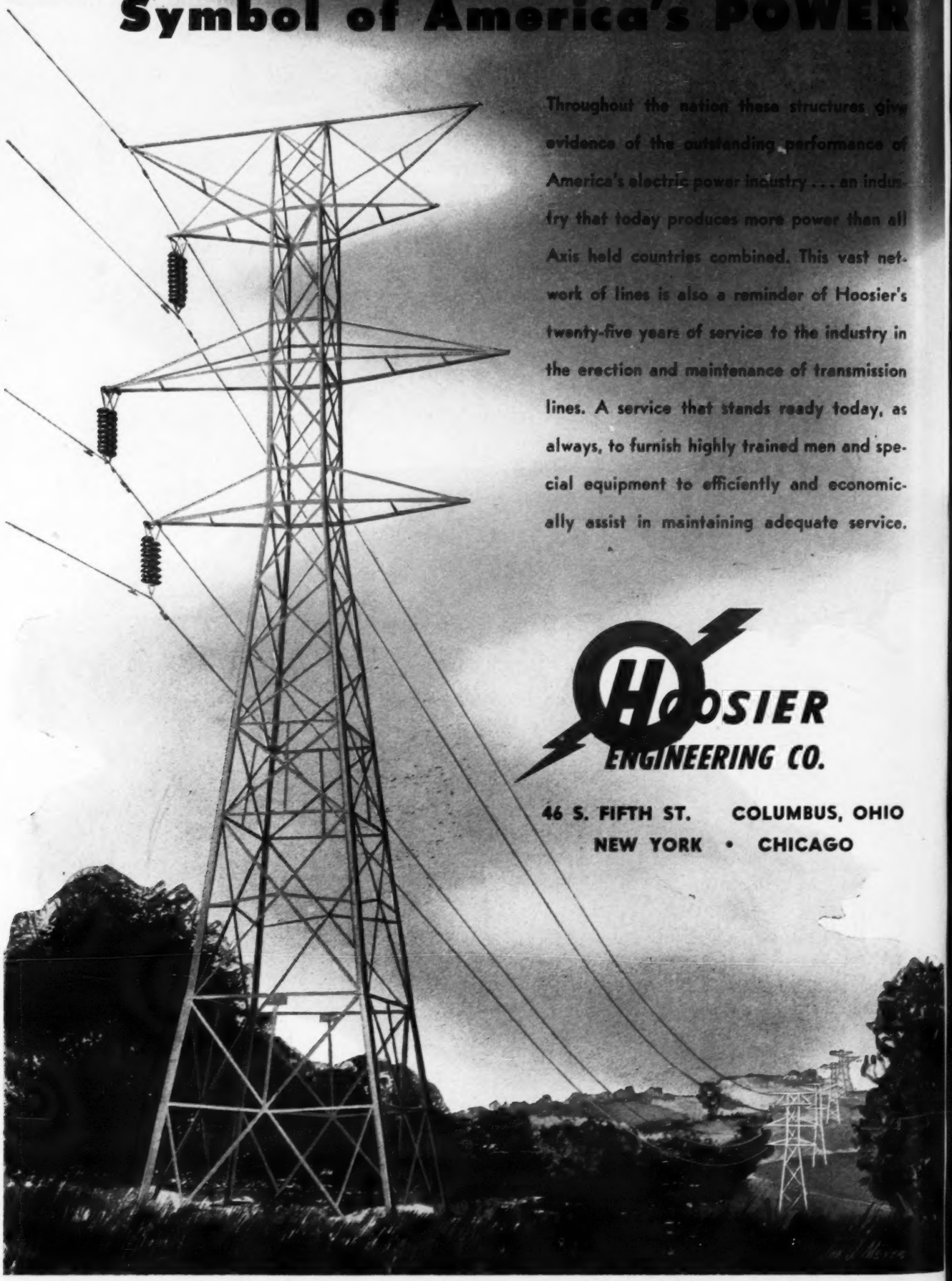
DROP FORGED HI-LINE HARDWARE

Through Your Insulator Manufacturer Only

BTC

CORTLAND, NEW YORK

Symbol of America's POWER



Throughout the nation these structures give evidence of the outstanding performance of America's electric power industry . . . an industry that today produces more power than all Axis held countries combined. This vast network of lines is also a reminder of Hoosier's twenty-five years of service to the industry in the erection and maintenance of transmission lines. A service that stands ready today, as always, to furnish highly trained men and special equipment to efficiently and economically assist in maintaining adequate service.

HOOSIER ENGINEERING CO.

46 S. FIFTH ST. COLUMBUS, OHIO

NEW YORK • CHICAGO

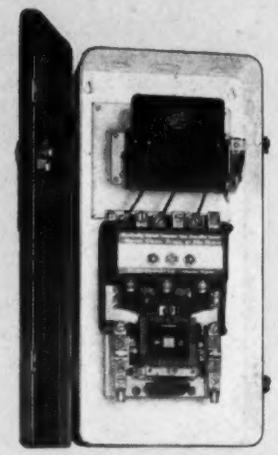
ERECTION AND MAINTENANCE OF TRANSMISSION LINES

Simplify your

CONTROL INSTALLATIONS WITH COMBINATION STARTERS

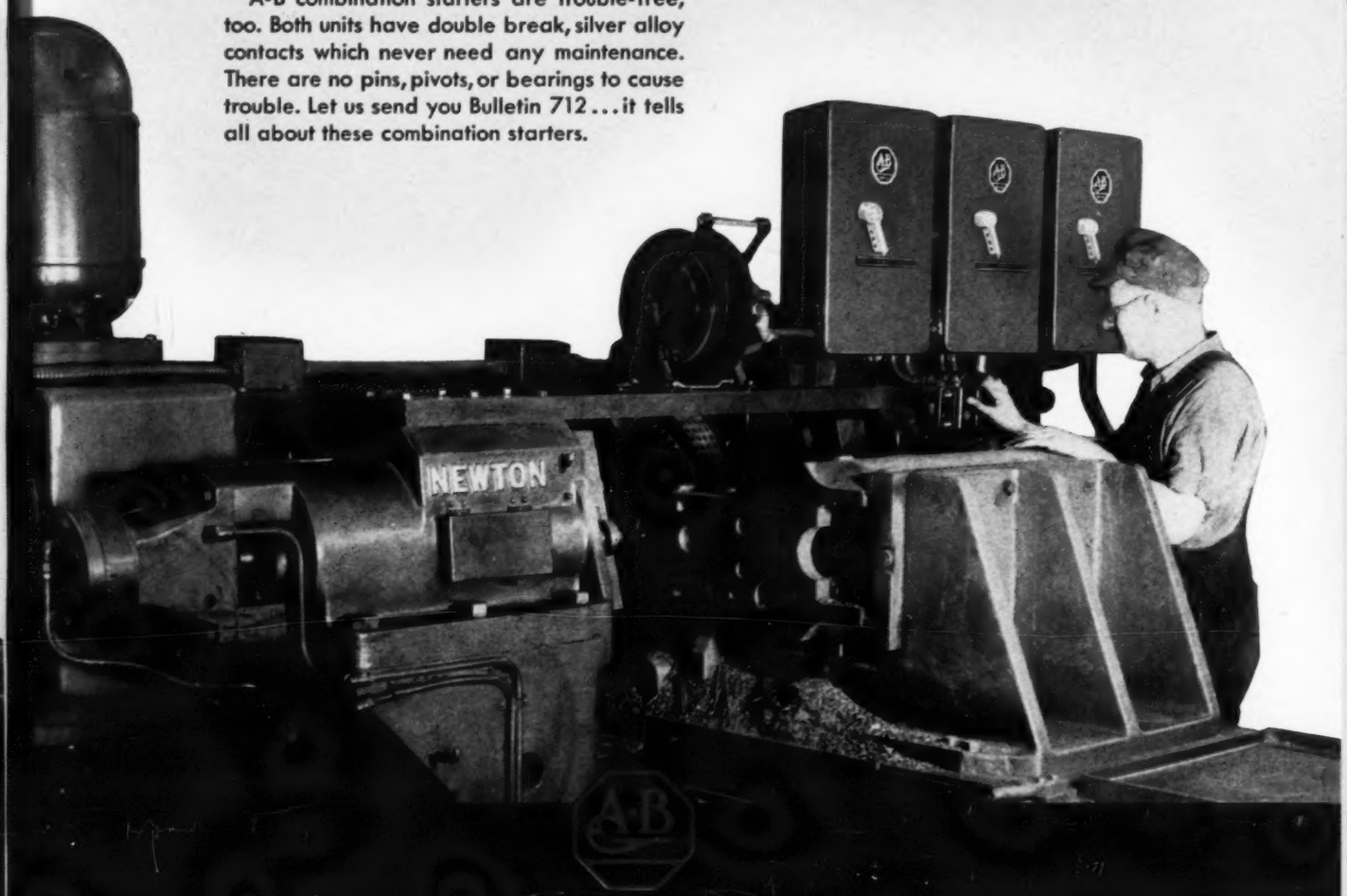
Motor controls are easy to install when you use Allen-Bradley *combination* starters. You save time, space, money, critical materials, and man power. You get a neater installation, because solenoid starter and disconnect unit are in one cabinet.

A-B combination starters are trouble-free, too. Both units have double break, silver alloy contacts which never need any maintenance. There are no pins, pivots, or bearings to cause trouble. Let us send you Bulletin 712 . . . it tells all about these combination starters.



Two units in one cabinet

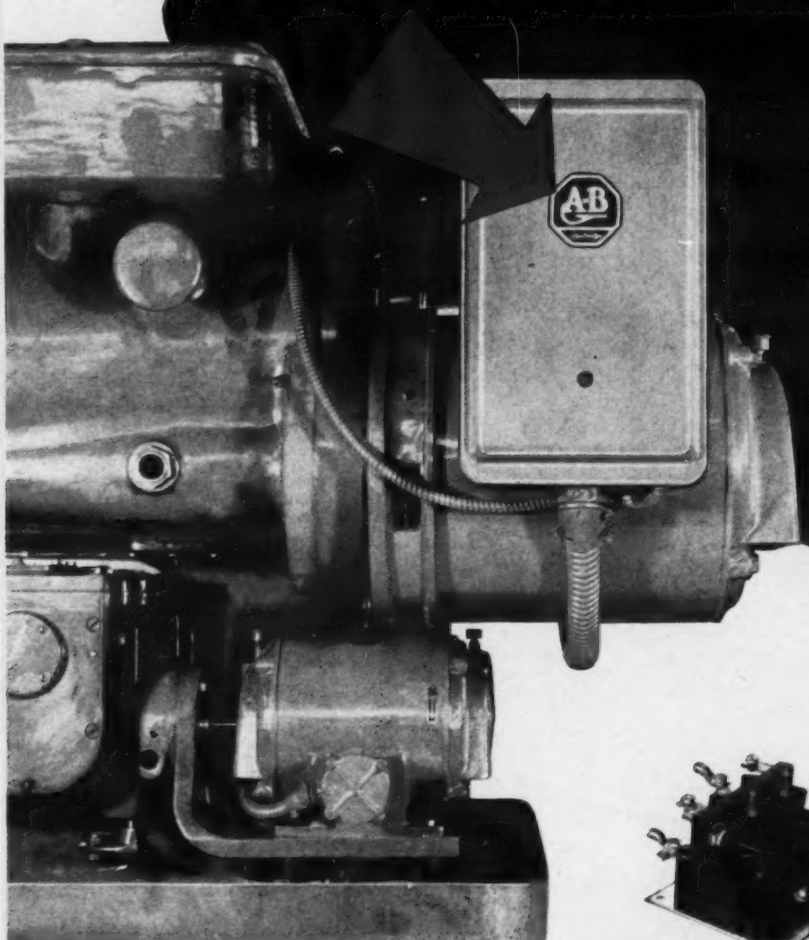
Bulletin 712 Size 2 combination starter with manually operated disconnect unit and solenoid starting switch in one cabinet. Three of these combination starters are used on the machine below.



ALLEN-BRADLEY

COMBINATION STARTERS

Here's a sure sign of
TROUBLE-FREE MOTOR CONTROL



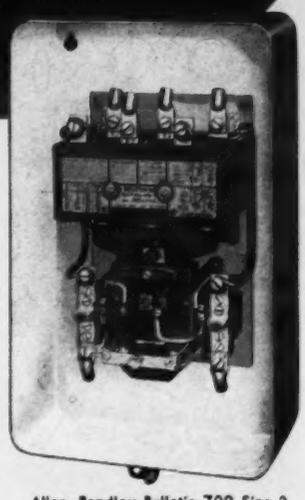
ONLY ONE MOVING PART

DOUBLE BREAK,
SILVER ALLOY CONTACTS

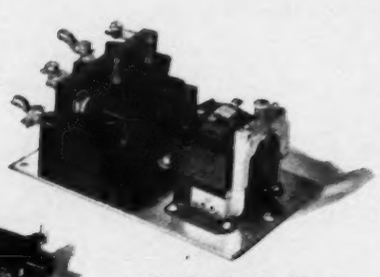
DEPENDABLE
OVERLOAD PROTECTION

HIGH INTERRUPTING
CAPACITY

SPLIT-SECOND ACCURACY

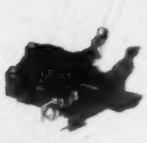


Allen-Bradley Bulletin 709 Size 2
Across-the-line Solenoid Starter

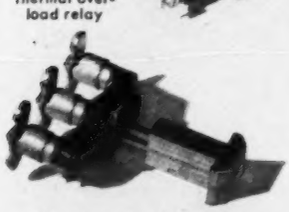


Arc hood and solenoid coil
mounted on solid steel plate

Arc hood cover



Thermal over-
load relay



Solenoid plunger with double
break, silver alloy contacts

The Allen-Bradley trade-mark is the mark of quality. A-B solenoid starters are dependable and trouble-free because they are so simple. They have only one moving part—the one-piece solenoid plunger that opens and closes the double break contacts with a straight-line vertical motion. There are no pivots, no pins, no bearings, no hinges, no flexible jumpers nor other trouble-breeders to cause starter failures. Furthermore, the silver alloy contacts never need to be filed, cleaned, or dressed. Just install A-B solenoid starters . . . and forget them. They're good for millions of trouble-free operations. That's why the A-B trade-mark means reliability and quality in motor control.

Allen-Bradley Company, 1316 S. Second Street, Milwaukee 4, Wisconsin.

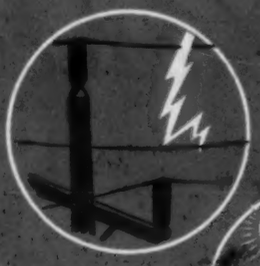
ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

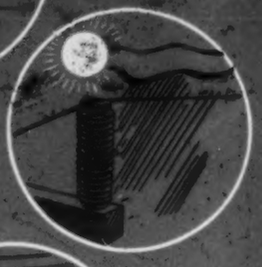
If you have insulator failures FROM ANY OF THESE CAUSES:

POWER ARCOVER

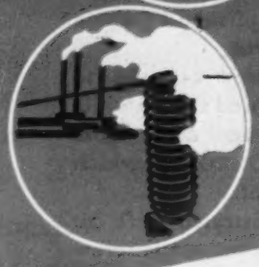


PUNCTURE

CRACKING



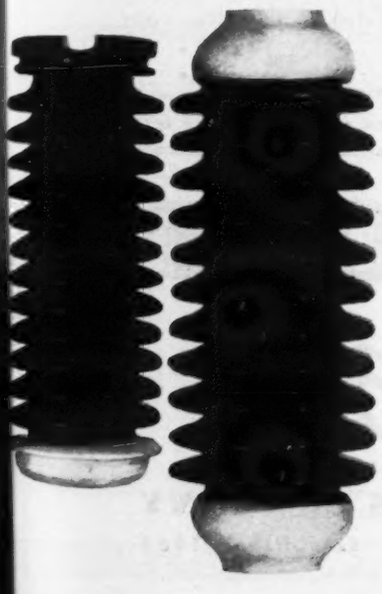
ATMOSPHERE COMTAMINATION



MECHANICAL ATTACK

You Need Lapp Posts!

• Looked at from a dollars-and-cents viewpoint—or in terms of man-hours of under-staffed and over-worked patrol and maintenance crews—Lapp Line Posts and Station Posts are smart business. For the engineering achievement of these insulators—now proved by more than 12 years of service in the toughest areas—is that of eliminating at their source *all* the common causes of high-voltage insulator failure. A one-piece post body, with multiple short rugged petticoats, this Lapp design is proof against puncture and cracking, is capable of withstanding enormous shock from power arcover or mechanical attack, provides uniform leakage path for operation under dirt conditions. For replacement, new construction or line conversion, Lapp Posts on your transmission lines and substations will give better performance and less trouble.

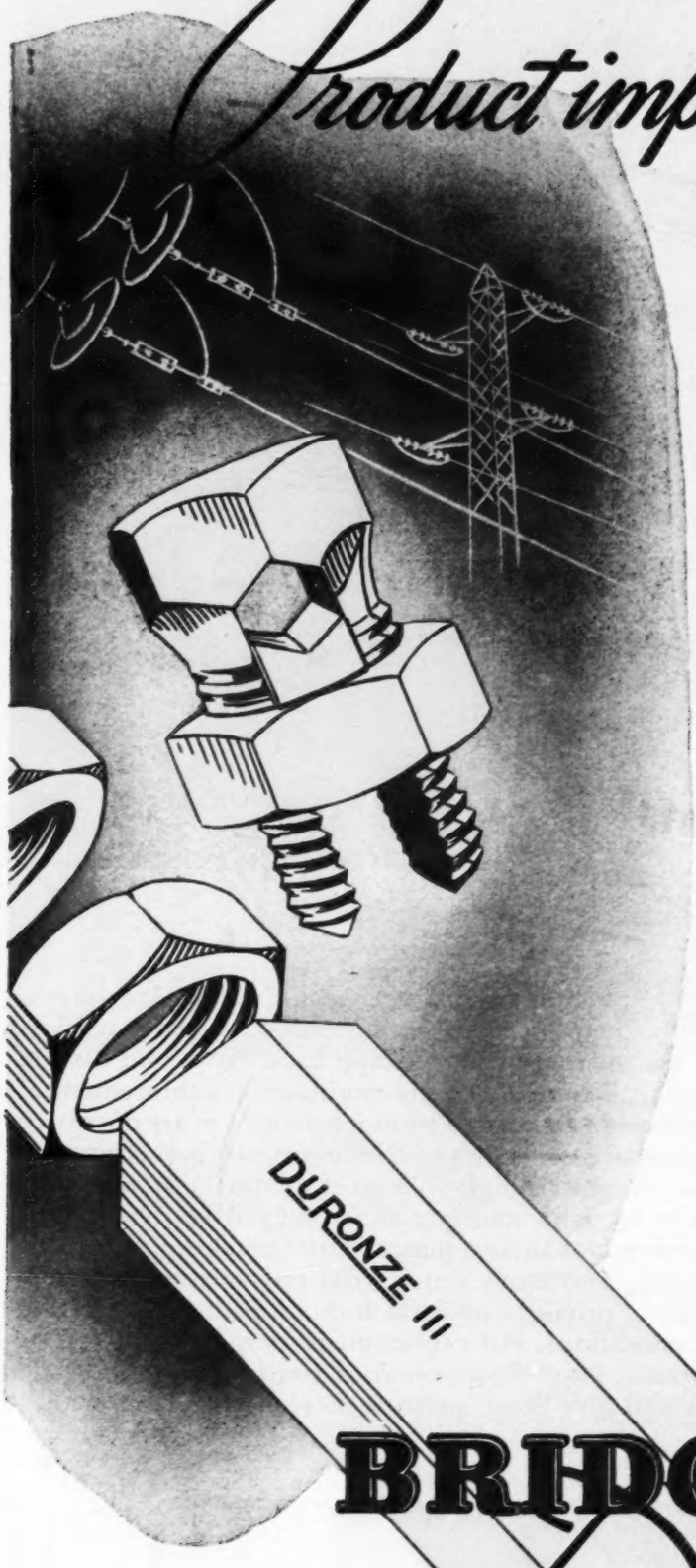


Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, N. Y.

Product improvement through

BRIDGEPORT DURONZE



Product improvement does not necessarily require radical changes in design or construction. Often it may be accomplished by using a better material for vital parts.

Wire and cable connectors exposed to severe weathering, corrosion and smoke while under stress do not fail when made from Bridgeport's high-strength DURONZE, which helps guard costly equipment.

Parts of the connector illustrated were cut from DURONZE III rod on an automatic screw machine. They average more than 90,000 pounds per square inch in tensile strength. Because DURONZE III is harder than most alloys, has a low coefficient of friction, and an extremely low creep value, the connector can be tightened more easily and retains its hold without loosening. It can also be used repeatedly without deterioration. Users of wire and cable connectors should specify DURONZE for their manufacture.

Are you working on improvement of existing products, or on future developments? If so, your plans may well begin with the selection of high-strength DURONZE for vital parts. Bridgeport's 80-page DURONZE Manual contains complete technical data on these modern engineering alloys. Write for your free copy today.

Mill orders will be accepted in accordance with existing priority regulations.

BRIDGEPORT *Duronze*

A PRODUCT OF

"Bridgeport" BRIDGEPORT BRASS COMPANY

BRIDGEPORT 2, CONN. • *Established 1865*

Type WMK Enclosed Safety Switch

CONDULETS

are **rain-tight.** You can use them in **both** indoor and outdoor non-hazardous locations. Also suitable for Classes III and IV hazardous locations. (NEMA Types 3 and 5)

Feraloy cases. Strong and durable. Four sturdy mounting feet. Many possible conduit arrangements for both horizontal and vertical through feed.

Safety. Positive interlock prevents opening the case unless switch is "off." Dead front switch held in "off" position while case is open.

Padlocks.

1. Cover may be padlocked to prevent unauthorized entry.
2. Operating handle may be padlocked "on" or "off."

Threaded operating shaft. Bearings permanently lubricated. Resists corrosion. Prevents the entrance of dust and moisture.

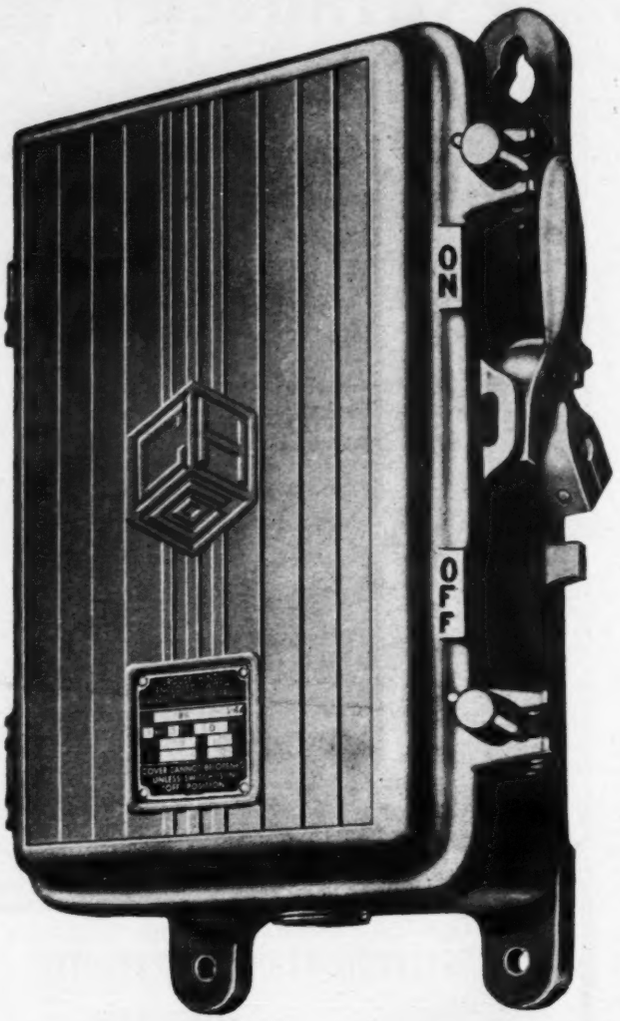
Switches. Quick make and break mechanism. Double break, reinforced, positive pressure-type blade and jaw construction. Positive pressure fuse clips. Combination solder or solderless wire lugs.

30, 60, 100 or 200-Ampere.
1 to 50-H.P.

125 to 600-volt, A. C.

2 or 3-pole, fusible or fuseless.

Listed in Condulet Catalog No. 2500, Section 50, Page 20A.



CONDULETS are manufactured only by CROUSE-HINDS

A Nationwide Distribution Through Electrical Wholesalers

CROUSE-HINDS COMPANY
SYRACUSE 1, N. Y., U.S.A.

Offices: Birmingham—Boston—Chicago—Cincinnati—Cleveland—Dallas—Denver—Detroit—Houston—Indianapolis—Kansas City—Los Angeles—Milwaukee—Minneapolis New York—Philadelphia—Pittsburgh—San Francisco—Seattle—St. Louis—Washington. *Resident Product Engineers:* Albany—Atlanta—Charlotte—New Orleans
CROUSE-HINDS COMPANY OF CANADA, LTD., *Main Office and Plant:* TORONTO, ONT.

CONDULETS · TRAFFIC SIGNALS · AIRPORT LIGHTING · FLOODLIGHTS

Presenting

THE COP

(Cut-Out-Premium)

STARTER

"One of Sylvania's Finest"

SYLVANIA FS GLOSTAT STARTER

WITH BETTER THAN EVER PERFORMANCE

A metal flag is spot-welded to the stationary contact post in the gas-actuated Sylvania FS Glostat Starter. This metal flag assures correct lamp cathode preheating. The new FS Glostat Starter is quicker-starting, can take rough handling, and preheats adequately for maximum lamp life. Recommended by Sylvania engineers for economy and efficiency in smaller fluorescent installations.

The COP (Cut-Out-Premium) Starter is ready to patrol your fluorescent installation to protect your lighting investment. The COP brings you the finest method yet designed by Sylvania engineers to cut a failed lamp out of the circuit.

The COP is equipped with a handy push button to reset the positive new circuit breaker. When you replace a failed lamp, you just push the button, and the COP continues to operate normally until another lamp fails.

The COP has shown a life expectancy five times that of the average starter in months of exhaustive tests under all possible operating conditions. That is why Sylvania particularly recommends the COP as a means of reducing the cost of maintaining fluorescent.

The COP stops annoying lamp blinking and flickering by cutting a failed lamp out of the circuit immediately.

The COP guards your electri meter, preventing waste o current.

The COP protects the ballast from overheating.

Post the COP, Sylvania's finest quality starter, on your ow fluorescent "beats." For information, write to Sylvania Electri Products Inc., Boston Street, Salem, Massachusetts.

One Standard—the Highest Anywhere Known

SYLVANIA

ELECTRIC PRODUCTS INC.

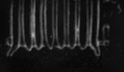
SALEM, MASSACHUSETTS

FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES, INCANDESCENT LAMPS, RADIO TUBES, CATHODE RAY TUBES, ELECTRONIC DEVICES

WHETHER YOU USE IT OUTDOORS

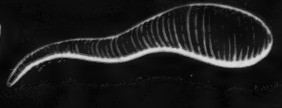
WHERE IT'S EXPOSED TO THE WEATHER

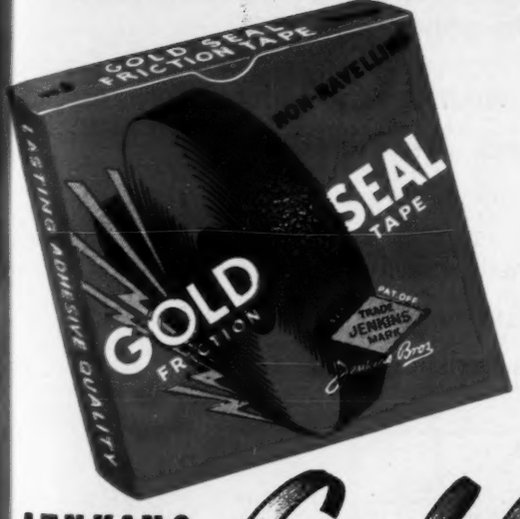
OR INDOORS WHERE IT'S WARM

AND DRY  OR UNDERGROUND

WHERE IT'S ALWAYS DAMP YOU'LL

FIND GOLD SEAL FRICTION TAPE

STICKS LIKE A  LEECH



HERE'S WHY-- If there's one quality users want in tape more than any other, it's *tackiness* – the ability to "stay put" wherever it's used. And tackiness is where Gold Seal Friction Tape shines! It sticks to the job like an umpire clinging to a close decision!

Gold Seal's tackiness comes from a formula developed by Jenkins Bros. Rubber Research Laboratories after months of testing. This compound of extra adhesive strength *coats both sides* of a fine quality base cloth. That's why Gold Seal Tape doesn't "peel" or dry out like ordinary tape . . . why it handles right and sticks tight right down to the last tenacious inch of the roll.

Gold Seal is sealed fresh in cellophane . . . carried by good supply houses . . . made by Jenkins Bros., Rubber Division, 80 White St., New York 13, N. Y.

JENKINS

Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet ASTM and Federal specifications.

Gold Seal Tape

FRICTION and RUBBER TAPES

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

ACCURATE PRODUCTION CONTROL = UNIFORMITY!

Production control is the key to sustained quality.

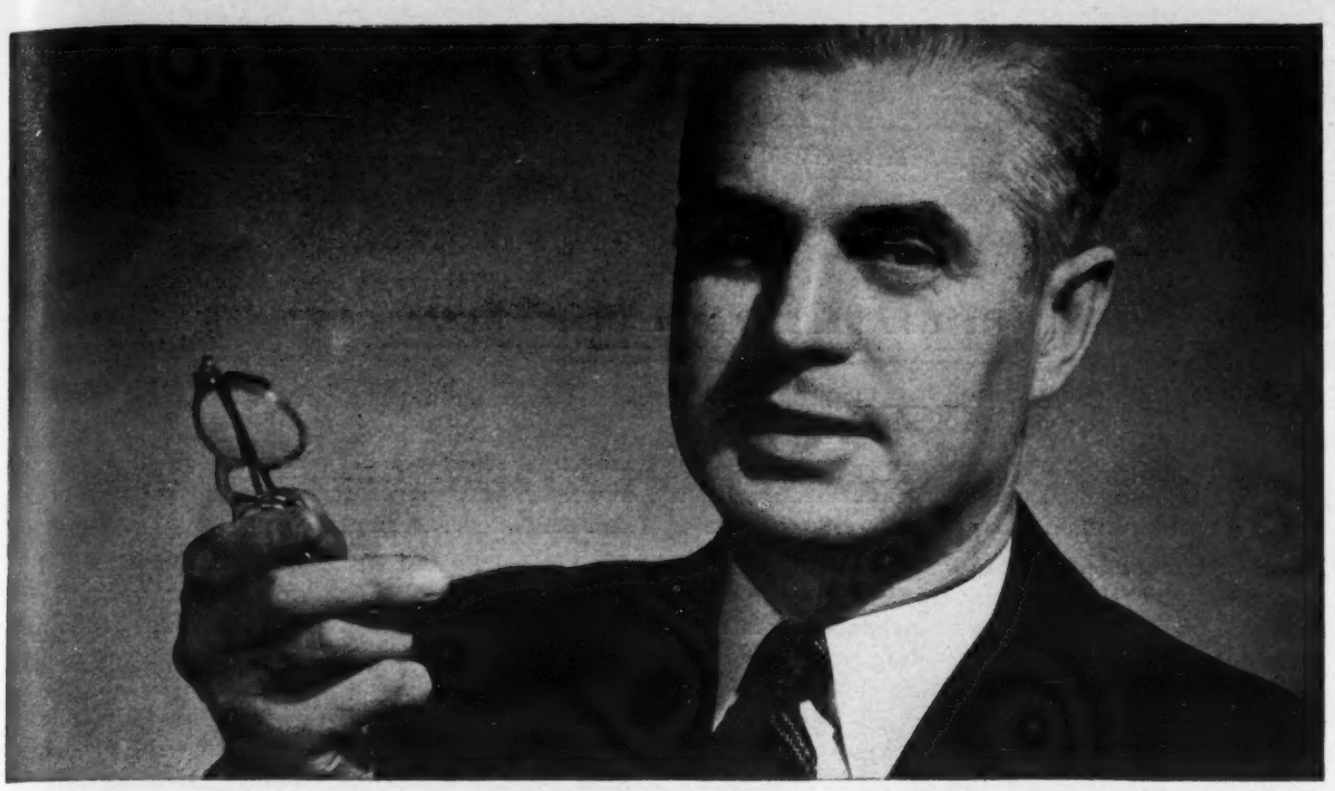
Therefore it is one of the most important weapons in the arsenal of any company that expects to grow.

Formica has always taken production control very seriously. Elaborate means are employed to check raw materials and manufacturing processes.

And the result over the years has been unusual uniformity in the product—the certainty for every customer that his production runs will maintain the same characteristic as the sample material which he originally tested.

FORMICA

THE FORMICA INSULATION CO., 4630 SPRING GROVE AVE., CINCINNATI 32, O.



"Load Drop" had us scared!

"SOME POWER PLANTS already are feeling the drop from terminated war contracts. It got us scared . . . till we quit worrying and started to *do* something. We've found the solution, and it's easier than you'd think."

Commercial Cooking is the Answer

Now is the time to list your commercial cooking and baking prospects and to do some pre-selling on the use of electricity for cooking. You'll find many eager to discuss it. Tired of humoring obsolete equipment, they are ready to cook this *modern* way at the first opportunity.

They are already your customers for lighting, motors, ventilation and refrigeration. Adding electric cooking will greatly increase your revenue.

Notice how Hotpoint-Edison advertising reaches hotels, restaurants, bakeries, hospitals and institutions—in their own trade publications. This is helping you. Take advantage of it in every way you can. It's reaching your prospects, who will be eligible for equipment later if not now.

Some Can Get Equipment Now

Tell prospective users of electric cooking that government regulations now permit the manufacture of a limited quantity of equipment for essential civilian use. If present equipment is inadequate or beyond repair, they should consult the local Hotpoint-Edison distributor or write to us.

It will pay also to list companies planning new buildings. Show them the economy, simplicity and convenience of bringing in only one fuel for lighting, power and cooking. If you do these things you won't need to fear "load drop."

Edison General Electric Appliance Co., Inc.
5618 W. Taylor Street, Chicago 44, Illinois

For outstanding achievement ARMY E NAVY in War Production

THE KITCHEN OF TOMORROW WILL BE ALL-ELECTRIC

Hotpoint Edison

COMMERCIAL ELECTRIC COOKING EQUIPMENT
RANGES • BAKE OVENS • ROASTING OVENS
DEEP FAT FRY KETTLES • BROILERS • GRIDDLES

OLDEST AND LARGEST MANUFACTURERS OF ELECTRIC COOKING EQUIPMENT

FOR VICTORY — BUY U. S. WAR BONDS AND STAMPS

CHALLENGE!

As you look through the ads in this magazine...

FIND THE GLASS PARTS NOT MADE AT CORNING

IT'S really not much of a gamble on our part. The truth is that most of the electronic glass equipment built today comes from Corning Glass Works.

Bulbs, flares, insulators, transformer bushings, tubing, resistor tubes, coil forms, are just a few of the hundreds of electronic glassware products produced under our Army-Navy "E" flag. Here you will find glasses with high electrical insulating qualities; glasses with an expansion coefficient practically equal to that of fused quartz; glasses extremely resistant to mechanical shock; glasses that can now be made into intricate shapes formerly considered impossible. And behind them all, 75 years of pioneering in glass research and experience gained in the development of more than 25,000 glass formulae.

We hope this doesn't scare you. All it means is this: If you have a problem you think glass might be helpful in solving, feel free to call on Corning! Everything we know about glass is at your service. Just to get started we'd like to send you a copy of an informative new booklet, "There Will Be More Glass Parts In Postwar Electrical Products." If interested, write Electronic Sales Dept. W-6, Bulb and Tubing Division, Corning GlassWorks, Corning, New York.

CORNING *means* Research in Glass

Electronic Glassware

R.M.REG. CORNING U.S. PAT. OFF. R.M.REG. PYREX U.S. PAT. OFF.

"PYREX" and "CORNING" are registered trade-marks of Corning Glass Works

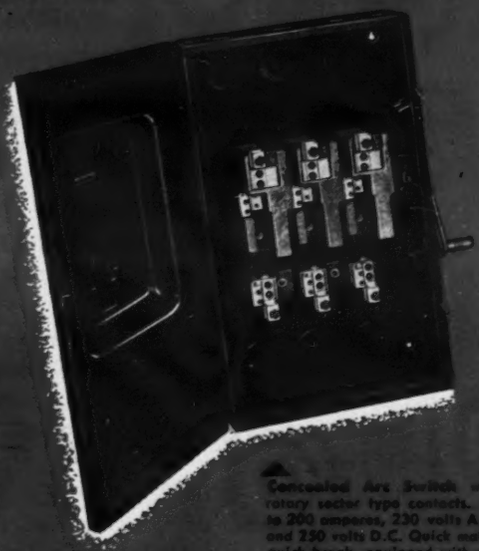
EXPERIENCE WAS OUR DESIGNER

Experience, the sum total of success in solving countless problems in electrical control, guided us in the design of these switches and panel boards. Experience has taught us what to avoid as well as what to do, constructively.

In these well built, long lived devices, simple but powerfully efficient, is the concrete evidence of many years of satisfying our customers. Let us discuss your electrical control problems and offer a solution. Our representatives are located in principal cities, coast-to-coast.

600 Volt Relarc Type Knife Blade Switch—30 to 600 amperes, 575 volts A.C. and 600 volts D.C. Maximum horsepower rated. Equipped with quick make and quick break mechanism and patented Federal Relarc arc snuffers. Available fusible and not fusible — 2, 3 and 4 poles. Equipped with Federal positive pressure type fuse clips.

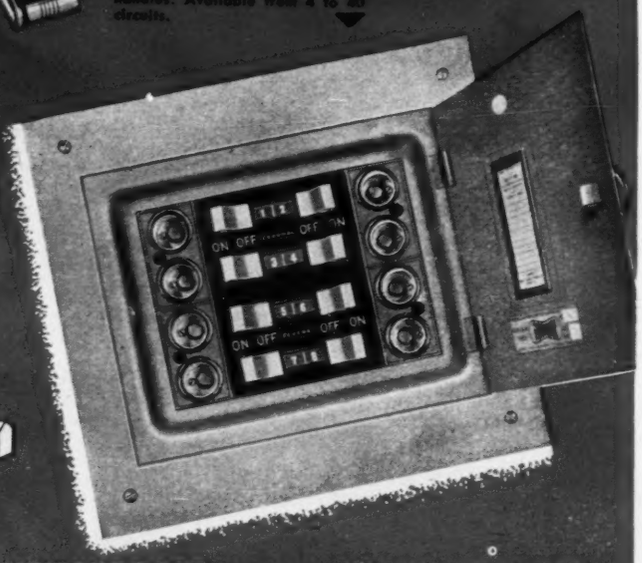
A smartly designed enclosure completes the sturdy, compact unit and protects Federal Switches.



Concealed Arc Switch with rotary sector type contacts. 30 to 200 amperes, 230 volts A.C. and 250 volts D.C. Quick make, quick break, equipped with defeatable cover interlock control. Fusible and not fusible 2, 3 and 4 pole — 3, 4 and 5 wire solid neutral. Equipped with Federal positive pressure type fuse clips.

Raintight Switch with Federal visible knife blade construction. 100 amperes, 2 pole, 250 volt D.C. no-fuse Type C. Equipped with cable strain hook. All Federal switches are available in raintight enclosures.

Federalite NTPS and NTPR Lighting Panelboards equipped with quick make and quick break toggle-type switches, molded Bakelite units with heavy duty switch handles. Available from 4 to 40 circuits.

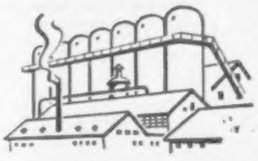


Federal

ELECTRIC PRODUCTS COMPANY
50 Paris St. • Newark, N. J.

SAFETY SWITCHES • PANELBOARDS • SWITCHBOARDS • CIRCUIT BREAKERS

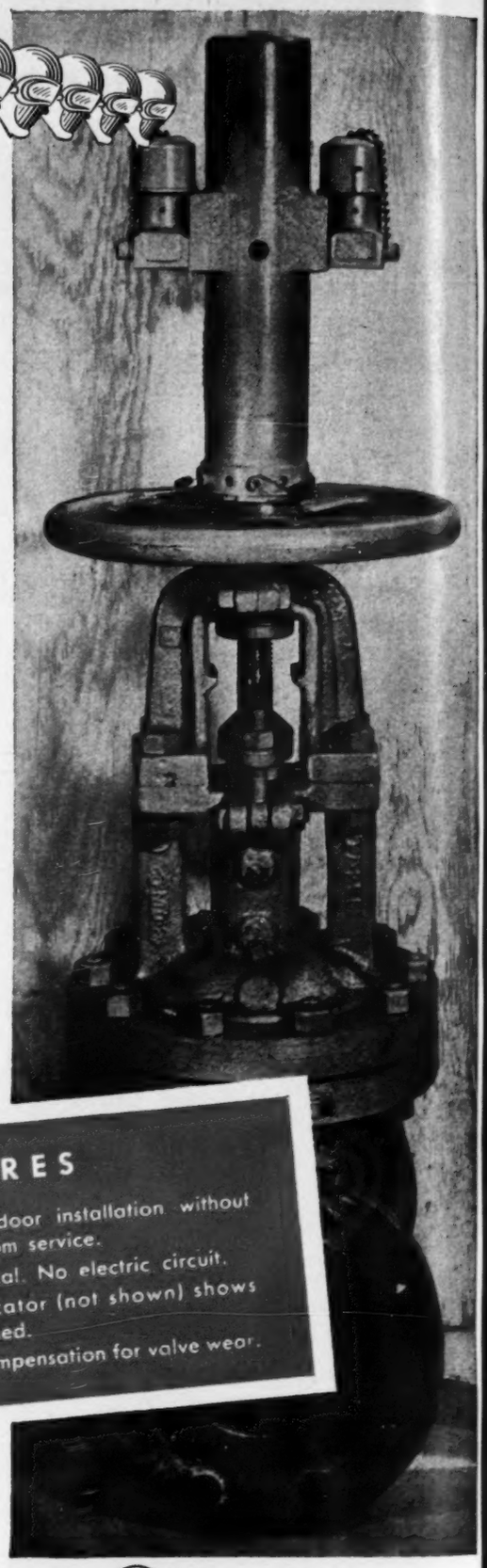
MECHANICAL GUARDIANS FOR CHEMICAL PIPE-LINES



In chemical industries, synthetic rubber plants, oil refineries... any plant, piping precious or potentially hazardous fluids... a mistake, whether unintentional or deliberate, in adjusting a chemical pipe-line valve can prove both dangerous and costly. But prevention of these human errors is easy and infallible with BENDIX-CORY* SAFETY INTERLOCKS... the locks that say "No!" to unauthorized handling of your valves.

The BENDIX-CORY SAFETY INTERLOCK illustrated gives absolute control over the opening and closing of the valve to which it is attached... and, by use of an interlock key, can also control the position of this valve in relation to any number of other valves. The unit is wholly mechanical, and fully adjustable to compensate for valve wear —one of a number of interlocks specially designed for valve protection.

As safety men of the Bendix "Invisible Crew," BENDIX-CORY SAFETY INTERLOCKS are dependable guardians for your pipe-lines. Write for full information.



CHECK THESE FEATURES

- Interlocks stem valves 2" to 8". Other interlocks for globe, lead and porcelain valves.
- Absolute control of valve opening and closing under all conditions.
- Positions valve in relation to other valves.
- Ample strength characteristics.
- Indoor or outdoor installation without removing valve from service.
- Fully mechanical. No electric circuit.
- Position indicator (not shown) shows valve open or closed.
- Adjustable compensation for valve wear.

*TRADE MARK OF BENDIX AVIATION CORPORATION

Products of this division are members of "The Invisible Crew"—precision equipment which 30 Bendix plants from coast to coast are speeding to our fighting crews on world battle fronts.

THE INVISIBLE CREW
Precision Equipment by
Bendix Aviation Corporation

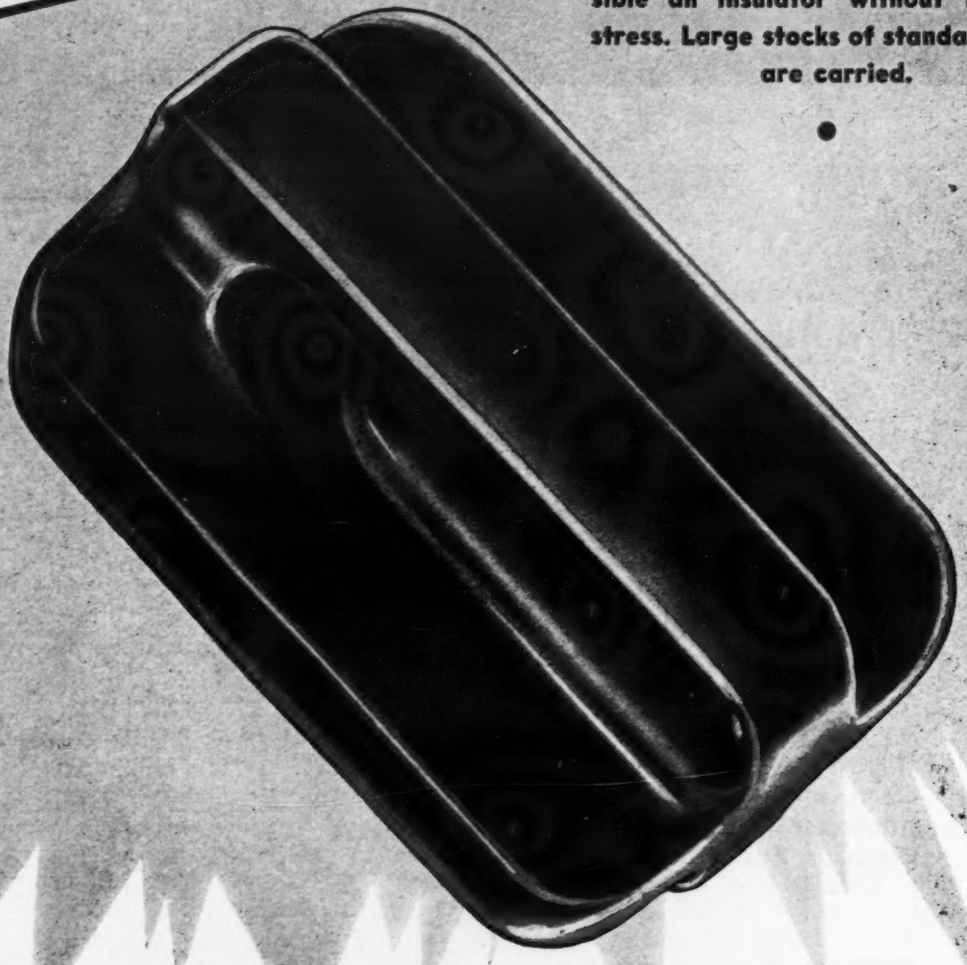
BENDIX MARINE DIVISION • One Hanson Place, Brooklyn, New York

NO INTERNAL STRESS

ILLINOIS WET PROCESS GUY STRAIN INSULATORS

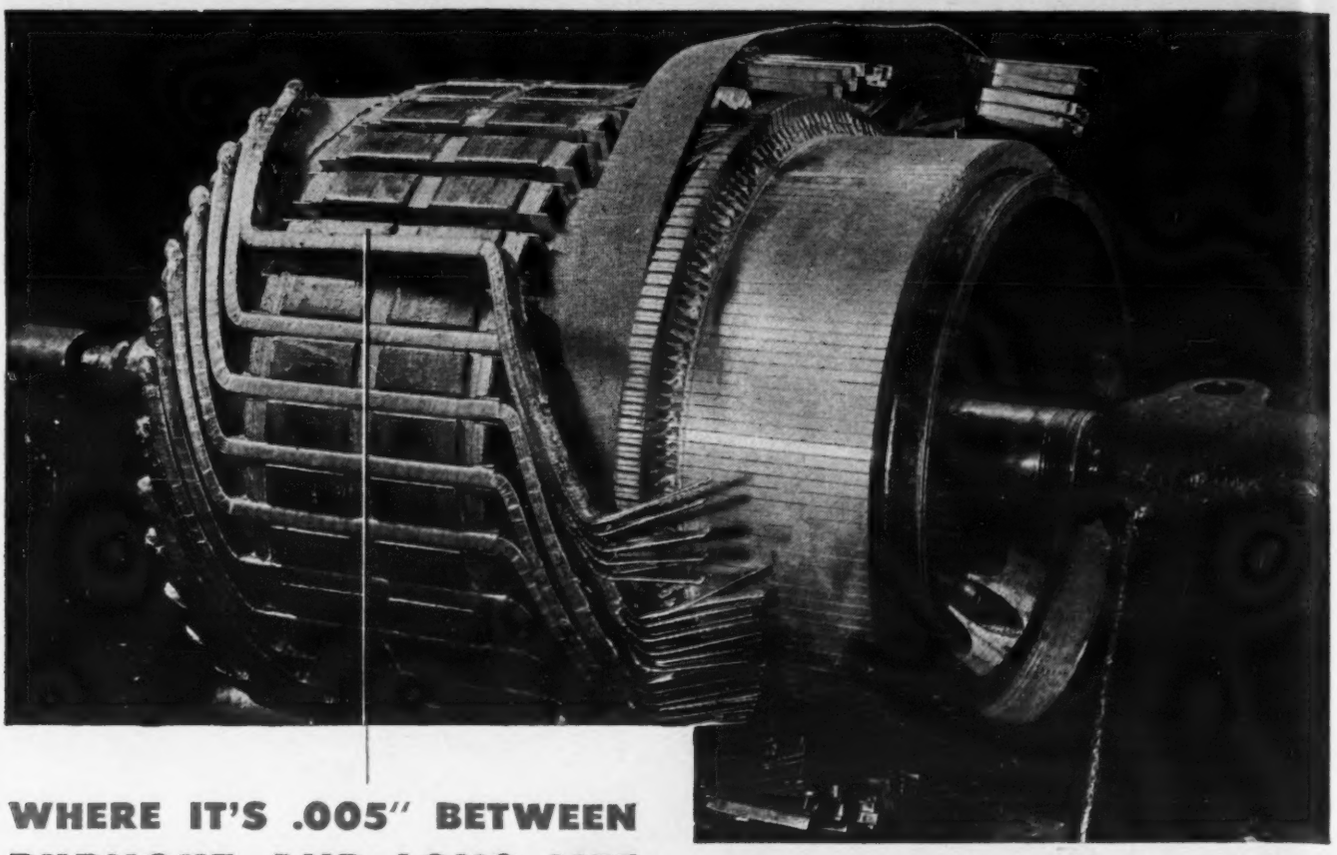
★ When you install ILLINOIS Wet Process Guy Strain Insulators you are sure of high mechanical strength and uniformity.

Only materials that meet our high specifications are used so that we can assure top quality wet process guy strain insulators. Plant control guarantees the proper handling of the material—careful firing makes possible an insulator without internal stress. Large stocks of standard sizes are carried.



•NON-POROUS •• HIGH MECHANICAL STRENGTH
•HIGH DIELECTRIC STRENGTH •• EXACT DIMENSIONS and UNIFORMITY

ILLINOIS ELECTRIC PORCELAIN CO.
MACOMB, ILLINOIS



WHERE IT'S .005" BETWEEN BURNOUT AND LONG LIFE

...use insulation proved by fifty years of field tests!

There can be *only one "right" insulation* where space limitations allow insulation only .005" thick. That's the one that's adequately tested and proved for the application.

For the right insulating material for any and every job—investigate the Westinghouse line of "Tuffernell" Insulating Materials. They're the culmination of *fifty years of field tests* with every type of electrical equipment. Westinghouse insulation experience with all conceivable types of insulating materials has built up an authoritative file of exact application data. All of it is made available to you through Westinghouse Insulation Specialists.

Some valuable portions of this "insulation know-how" are included in the new Insulation Sample Book which simplifies selection of Micas, tapes, fabrics and papers *with actual samples*. It helps identify different grades, gives dimensions, ratings, and helpful application data. Copies are available through your nearest Westinghouse distributor. Ask for B-3322. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N. J-06356

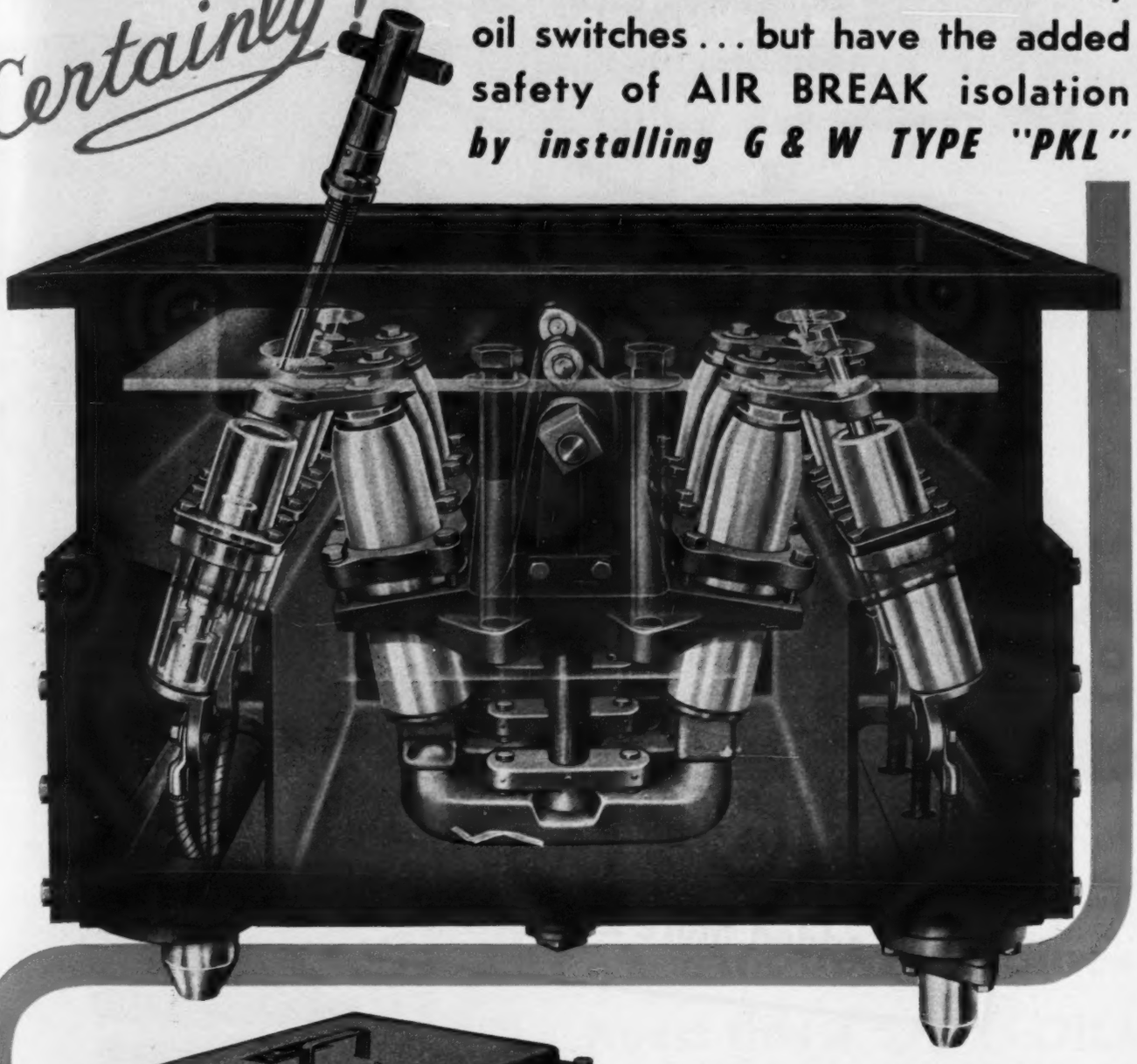
Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

INSULATING MATERIALS

Certainly!

Use full load break subway oil switches . . . but have the added safety of AIR BREAK isolation *by installing G & W TYPE "PKL"*



You get greatly increased flexibility in your distribution system, greater ease of maintenance, and utmost safety — when you install G & W Type "PKL" Air and Oil Break Switches.

You can quickly isolate the underground cable circuit in case of trouble, or when changes and extensions are required.

With an air break disconnection on either side of the oil switch, you simply withdraw the plug connectors to leave definite air separation between oil switch contacts and cable terminating contacts. The switch is then isolated for inspection, and the cables can be given attention with entire safety. The insulating shield at the top is transparent "Plexiglas".

Send for Bulletin 543

G & W ELECTRIC SPECIALTY CO.

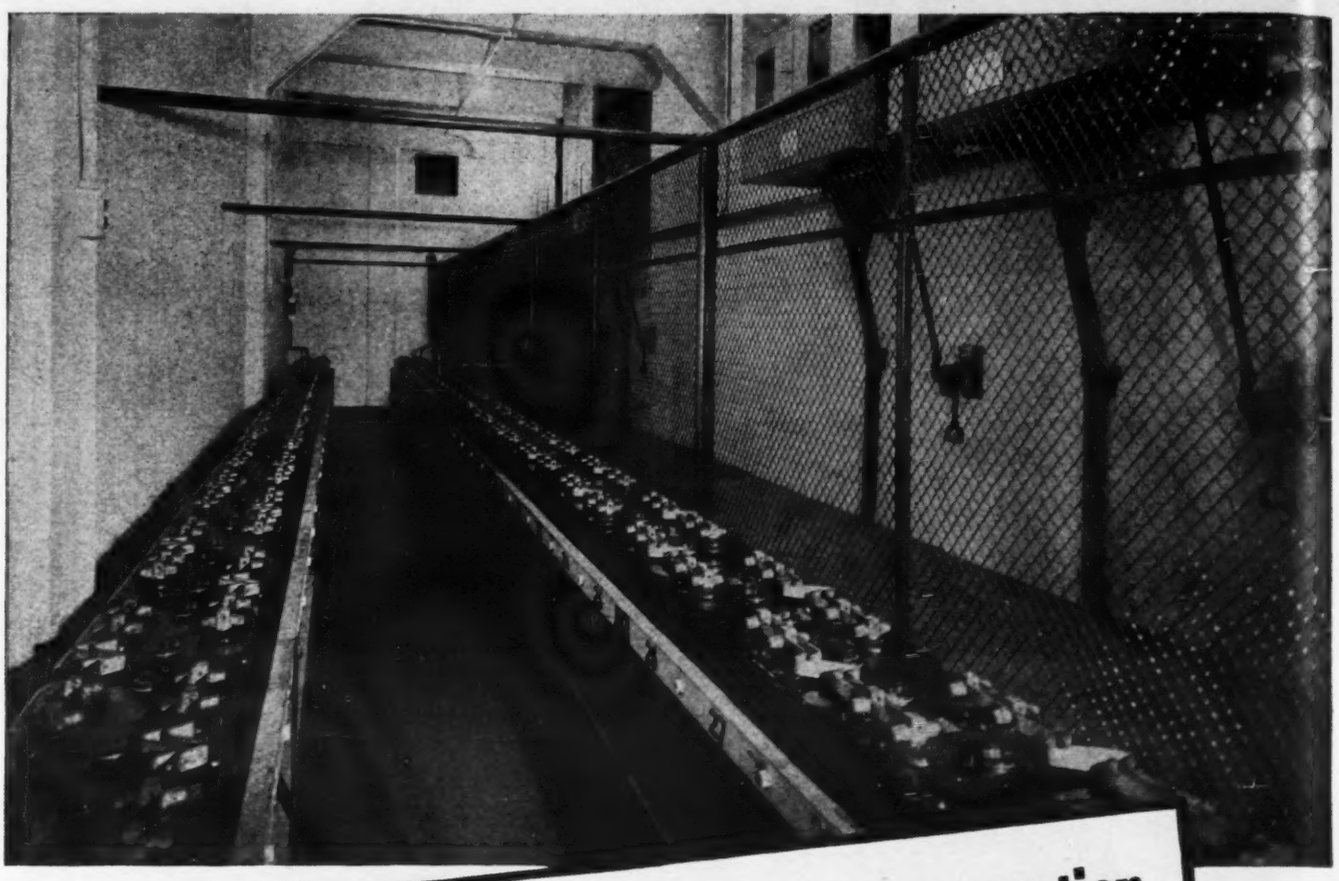
7780 DANTE AVENUE, CHICAGO, ILL., U. S. A.

Also made in Canada by Powerlite Devices, Ltd., Toronto

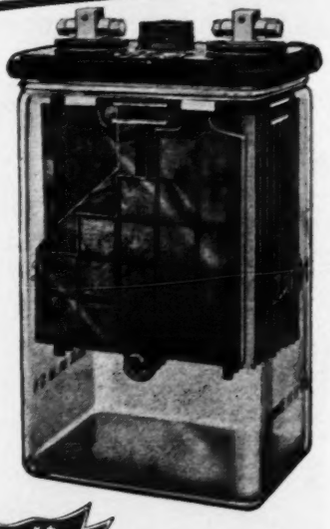
G&W ELECTRIC CABLE DEVICES

POTHEADS . . . BOXES . . . OIL FUSE CUTOUTS . . . OIL SWITCHES AND MULTIPLE CIRCUIT OIL DISCONNECTS

60 FM-17 Control battery at Station "B" of San Diego Gas and Electric Company, San Diego, California.



When San Diego increased generation they added more Exide-Chloride Batteries



After 17½ years of peak performance in supplying power for oil switch operation, emergency lighting, etc., the San Diego Gas & Electric Company replaced their 60 cell FMGF-13 Exide-Chloride Battery with a 60 cell FM-17 Exide-Chloride.

The Company's Station "B" Steam Generation Plant, located in San Diego, California, had installed additional generation and switch equipment and a larger battery was needed. After so many years of faithful, efficient service from the old battery, it was only natural that San Diego should choose another Exide-Chloride. No wonder San Diego sticks with Exide. They're built to last and will serve to win.

THE ELECTRIC STORAGE BATTERY CO., Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

ARMY E NAVY

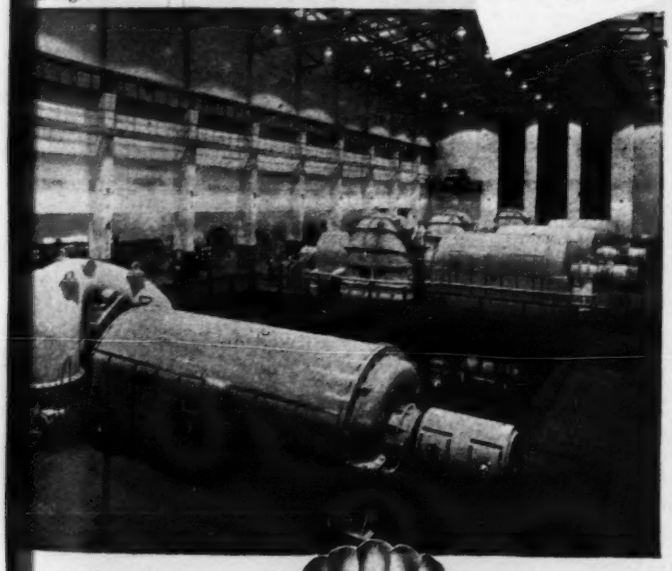
Exide
CHLORIDE
BATTERIES

BUY MORE THAN BEFORE IN THE 5TH WAR LOAN

When the DIVERGING NOZZLE was a "new development" a 1-Job turbine oil was good enough

Although the expanding nozzle was patented in 1867, for steam injectors, Gustaf De Laval is given credit for being the first to apply the principle of a diverging nozzle for the expansion of steam to a turbine. It was in 1888 that he first experimented with the diverging expansion nozzle. But the high velocity of the steam in this type nozzle made it very difficult to balance a wheel with sufficient accuracy. De Laval then combined the flexible shaft with the diverging nozzle, as shown in the sketch above

odern turbines may embody many of erational principles of those first tur- of the late 1800's, but the speeds and mperatures at which modern turbines e demand an oil that does more than te. They need Shell Turbo Oil . . . the il that prevents rust, and at the same as the ability to resist oxidation to an l degree.



. . . But modern turbines need this 2-JOB OIL!

1. That prevents rust

2. That has superior oxidation stability

IF YOUR TURBINES are of modern design, and you're using simply a "good turbine oil"... look out! That's not enough. To keep the modern steam turbine operating dependably, efficiently and economically, your oil must have the ability to do 2 jobs—(1) *prevent rust*, (2) *resist oxidation* to an unusual degree. Shell Turbo Oil does *both* of these jobs at once . . . does them so well, in fact, that it has been turning in outstanding performance records.

Shell Turbine Oil was the first of its type to be approved as meeting rigid U. S. Navy specifications. And it is Shell Turbo Oil that is still going strong after 20,000 hours operation in the turbo blowers of a leading steel company, where previous turbine oils used did not last more than 4000 hours. There are other equally impressive records of Shell Turbo Oil we'd like to show you. Write: Shell Oil Company, Inc., 50 West 50th St., New York 20, N. Y., or 100 Bush St., San Francisco 6, Calif.

SHELL

TURBO OIL

TH TRANSTAT A. C. VOLTAGE REGULATOR FOR COMMERCIAL RATINGS AND FREQUENCIES.

6 "EXTRAS" GIVE LONG, UNINTERRUPTED LIFE TO TRANSTATS' SMOOTH CONTROL

Well known for their potentiometer smoothness and transformer efficiency, TH Transtat A. C. Voltage Regulators are strikingly demonstrating another quality—long, trouble-free performance.

The cut-out view above reveals some of the reasons for Transtat ruggedness:

(1) VARNISH IMPREGNATED CORE AND COIL form a solid mass that will not loosen in service.

(2) ADEQUATE TURN-TO-TURN INSULATION AND SOLID INSULATING MATERIAL between commutator bars assured by combination of extra wire insulation and varnish impregnation.

(3) BROAD, UNIFORM COMMUTATING SURFACE results from grinding commutator track on the parallel, uniformly spaced wires of the outside, cylindrical portion of the coil.

(4) SMOOTH, COMMUTATING SURFACE: no bumps jar the brush to cause breakage or arcing.

(5) LONGER BRUSH provides sturdiness, larger heat dissipating surface, and a greater contact area that reduces the current density per square inch of brush contact.

(6) BALANCED COLLECTOR ARM maintains brush setting when mounted in any position.

These features assure long, dependable life for Transtat Voltage Regulators. Yet Transtats are no more expensive than many other voltage regulating devices. For a continuously adjustable voltage or a constant voltage from a fluctuating source, specify Transtats. Write today for complete information covering manually operated Transtats. Ask for bulletin 51-2N.

THE AMERICAN TRANSFORMER CO., 178 Emmet St., Newark-5, N. J.

Pioneer Manufacturers of Transformers, Reactors and Rectifiers for Electronics and Power Transmission

AMERTRAN

MANUFACTURING UNIT AT NEWARK, N. J.

AMER TRAN

CAN WE HELP YOU SAVE FUEL

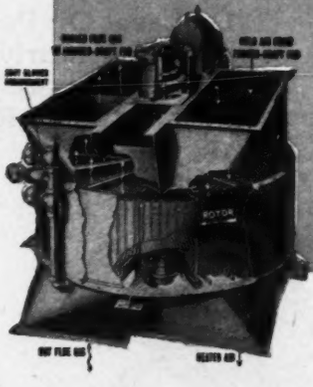
by PREHEAT *Engineering?*

If you want to improve the combustion of low-grade fuels... raise the level of heat recovery... conserve critical materials in plant design... you or your consultants can make profitable use of Preheater experience. Let our specialists tell you more about the Ljungstrom Air Preheater, and the outstanding job it has done for hundreds of America's leading industries and public utilities, where the need for preheated air from 300F to 1500F was part of their problem. Our engineers are ready to work with you in applying the Ljungstrom to your own heat recovery problem.

Among the Users of the LJUNGSTROM AIR PREHEATER:

- PUBLIC UTILITIES
- OIL REFINERIES
- SYNTHETIC RUBBER PLANTS
- STEAM GENERATION PLANTS
- MEAT PACKING PLANTS
- ORDNANCE PLANTS
- CHEMICAL PLANTS
- STEEL MILLS
- PAPER MILLS
- AUTOMOBILE MANUFACTURERS
- METALLURGICAL PLANTS

In the Ljungstrom, a compact heating unit soaks up heat in the gas chamber and liberates it into the entering air. Its efficiency is unusually high for its size and weight. In many cases, the weight of a Ljungstrom Preheater will be ⅓ to ½ that of other types for the same heat recovery.

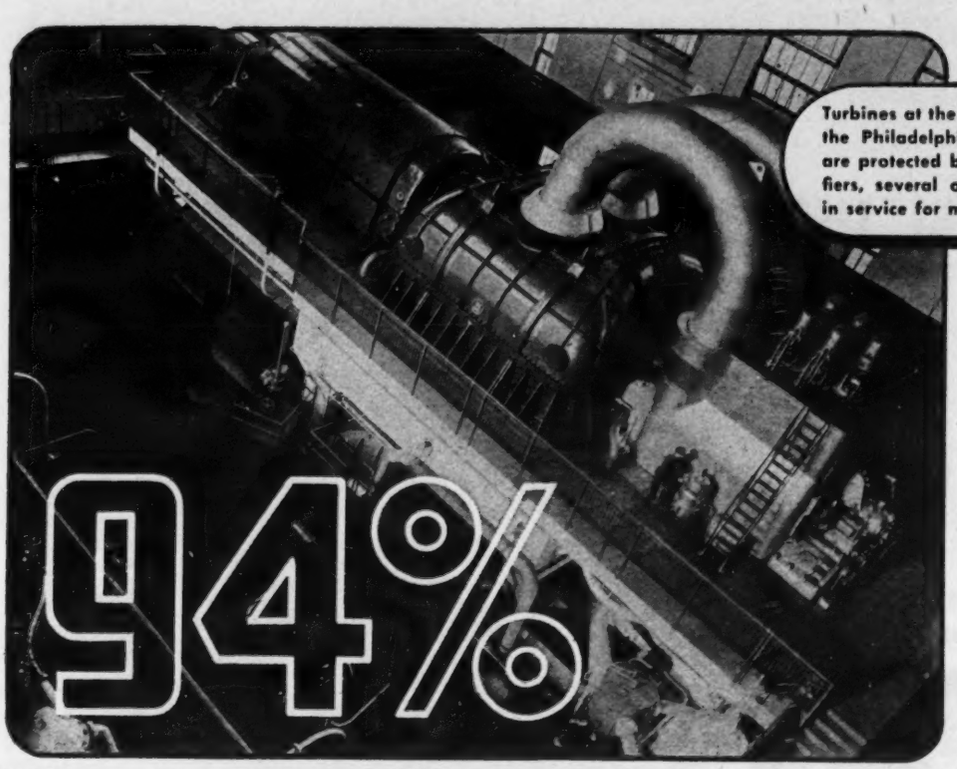


THE

AIR PREHEATER

CORPORATION

Executive Offices: 60 East 42nd Street • New York 17, N. Y. • Plant: Wellsville, N. Y.



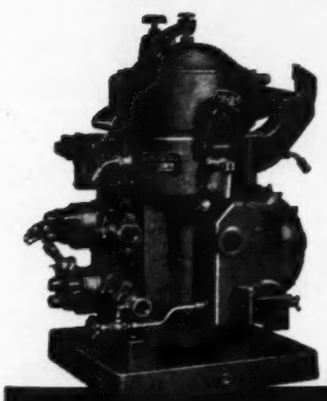
Turbines at the Richmond Station of the Philadelphia Electric Company are protected by De Laval Oil Purifiers, several of which have been in service for many years.

of the LARGEST POWER SYSTEMS *use* DE LAVAL OIL PURIFIERS—

DE LAVAL Oil Purifiers are used by 94% of the largest power systems in this country to maintain the efficiency of turbine lubricating oil or to maintain insulating oil at required high dielectric value, or for both services.

De Laval Oil Purifiers are available as stationary, semi-portable, or fully portable units. "Uni-Matic" self-contained units include Purifier and pumps, heaters when desired, gauges, sampling cocks, etc. A blotter press may be included as an auxiliary for the removal of colloidal carbon from circuit breaker oil. Individual Purifiers are also obtainable in a wide range of capacities. Processing systems, such as the De Laval-Funk method of continuously maintaining the efficiency of turbine oil, are also available.

De Laval Oil Purifiers are *more* efficient, *more* economical, and are supplied in types *more* nearly suited to the needs of the individual plant or system. Hence, they are preferred by *more* companies having need for oil purification equipment. Write for additional details.



THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

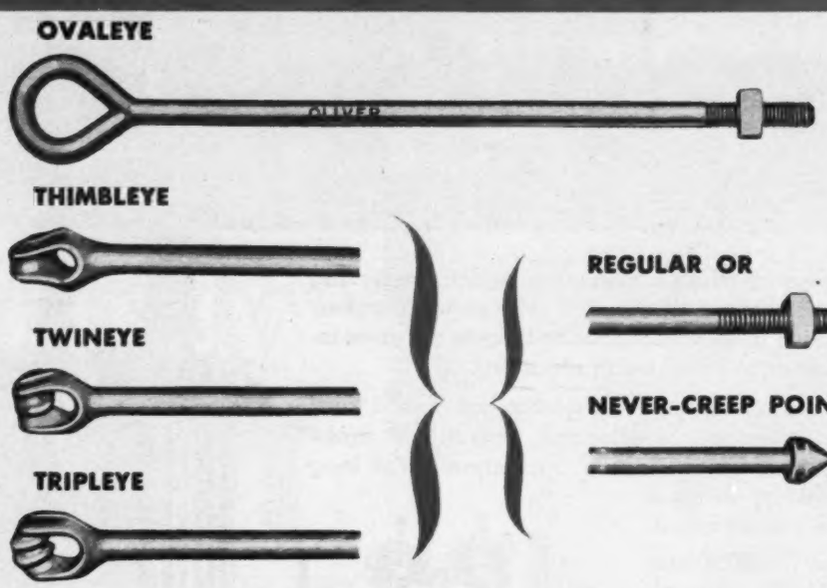
DE LAVAL OIL PURIFIERS

OLIVER

ANCHOR RODS

FOR EVERY CLASS OF SERVICE

. . . from the COMPLETE LINE OF OLIVER LINE MATERIALS

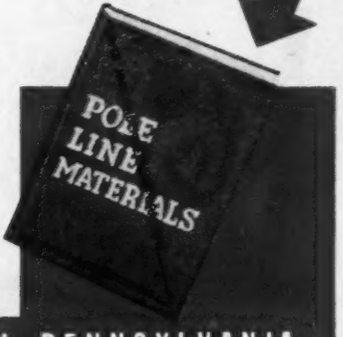


Oliver Anchor Rods are made in sizes and types for use with all varieties of expanding and cone anchors, and some screw anchors.

Sizes of Oliver Anchor Rods are: diameters, ½ inch to 1¼ inches; lengths 5 to 10 feet. All are of drop forged steel, heavily galvanized.

The thimbleye, twineye and tripleye construction protects the strand, makes thimbles unnecessary and simplifies erection. Flat top aids driving.

If you haven't received a copy of the Oliver Catalog of Pole Line Materials (No. 43) send for it today.

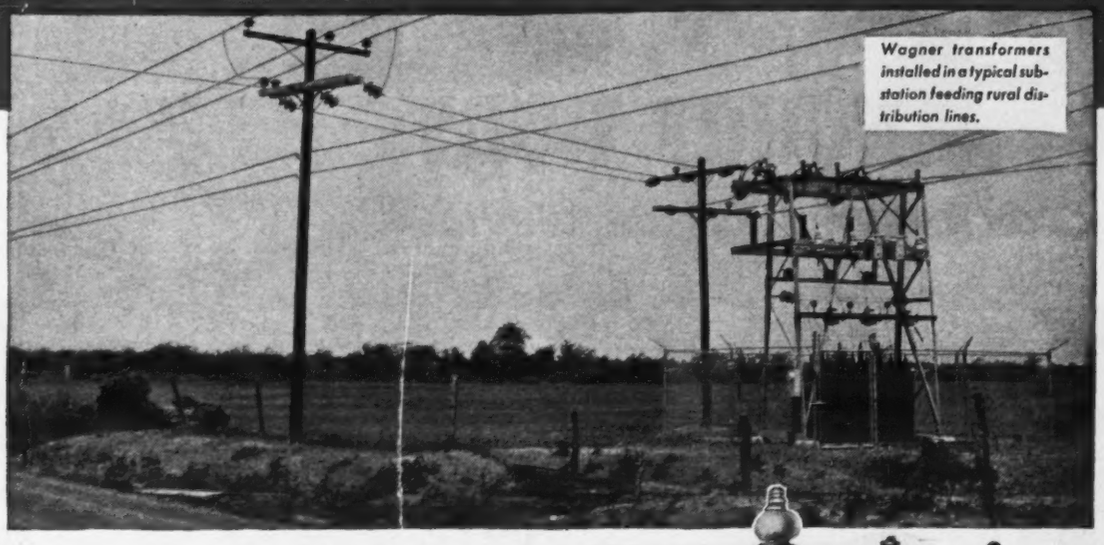


OLIVER
IRON AND STEEL
Corporation

SOUTH TENTH AND MURIEL STREETS • PITTSBURGH, PENNSYLVANIA

Wagner

SUBSTATION TRANSFORMERS

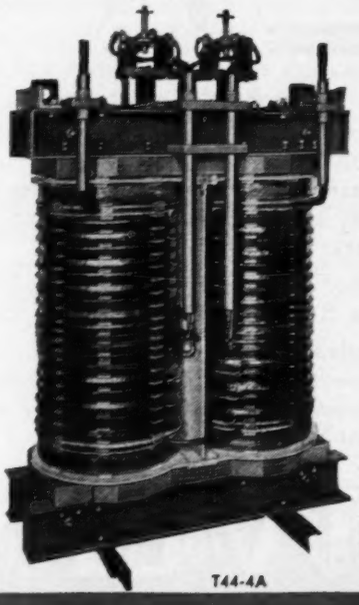


Wagner transformers installed in a typical substation feeding rural distribution lines.

Throughout the country many transformers, which are serving in substations feeding rural distribution systems from higher-voltage transmission lines, are overloaded due to the great increase in the number of farms being electrified.

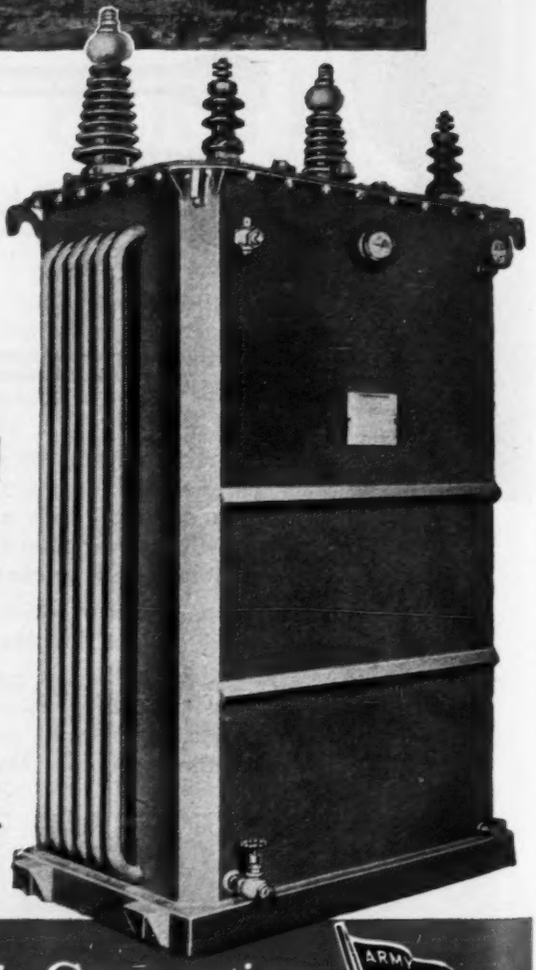
Eventually these transformers must be replaced, so if your substation transformers are overloaded you should make plans to replace them with Wagner transformers. For long life and dependability Wagner transformers are unsurpassed.

Write for Bulletins TU-180 (Distribution), and TU-181 (Power). They are yours for the asking.



T44-4A

Typical core-type element used in Wagner substation transformers. High-voltage side shown in illustration. Wagner substation transformers are available in all standard kva sizes and voltage ratings.



MOTORS
TRANSFORMERS
UNIT SUBSTATIONS
INDUSTRIAL BRAKES
BRAKE LINING

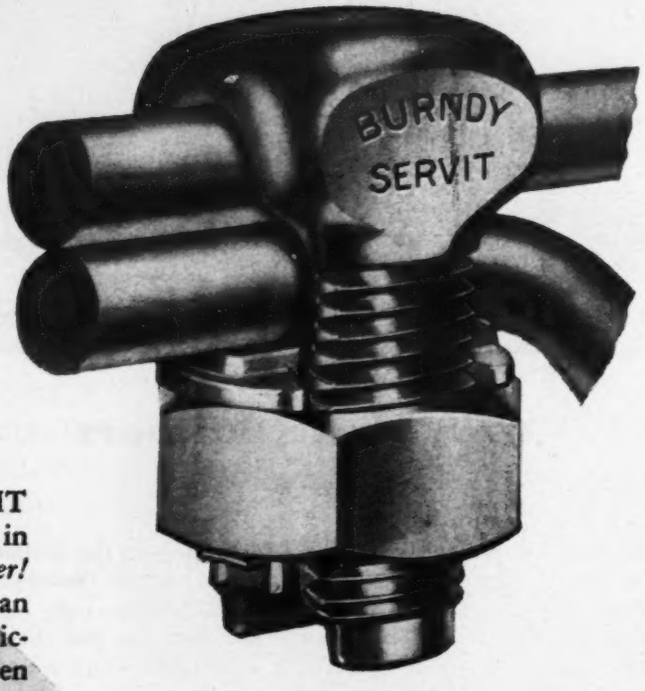
Wagner Electric Corporation

ESTABLISHED 1891

6456 Plymouth Avenue, St. Louis 14, Mo., U. S. A.

ELECTRICAL AND AUTOMOTIVE PRODUCTS

FORGED *for Strength*



Burndy SERVIT

FORGING, alone, would make the SERVIT strong . . . but the *high strength* alloys used in its construction, make the SERVIT *even stronger!* And with this high strength, SERVIT provides an engineering design which materially reduces friction and permits far higher compression between conductors. Thus SERVIT'S higher contact pressures can be developed and *maintained indefinitely.* Available for conductors from #10 wire to 1,000 mcm cable.

For all other electrical connector requirements, too . . . overhead, underground, grounding, or even for sensitive electronic circuits . . . Burndy has the answer you seek. Literature, or complete engineering cooperation is freely offered.

Headquarters for CONNECTORS

Burndy

ENGINEERING CO., INC.

107 BRUCKNER BLVD., NEW YORK 54, N. Y.

SERVIT HERE... SERVIT THERE... SERVIT EVERYWHERE!

They make bombers Fighting Mad

Bombers are pretty peaceful articles resting on the ground. But up in the air they're different birds. There's fire in their eyes.

What happens between the minute a bomber rolls out of a hangar and the time it takes to the air? Brother, you should see!

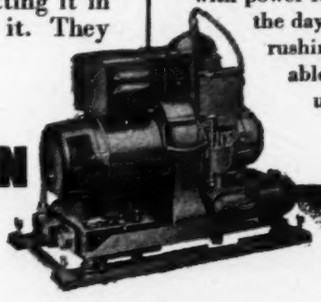
The busiest group of men you'll ever know start working on their pet. They gas her up. They stow the bombs. They check everything on the plane. And off to the side you'll see (and hear) the purr of the ground crew's faithful "putt-putt."

It's a Homelite Portable gasoline-engine-driven Generator . . . small, compact and *busy* . . . working for all it's worth, furnishing power for charging the plane's batteries and testing its electrical equipment . . . helping the boys in the ground crew to get the plane fighting mad.

It's not an easy life sparring with a bomber . . . getting it in fighting condition. But Homelites are able to take it. They do the job.

They Improve Dispositions

On the home front, Homelite gasoline-engine-driven generators are a blessing to busy construction men. Speeding up work with power for electric tools . . . stretching the day with night time lighting . . . rushing to emergencies with portable power . . . these Homelite units are always on the go.



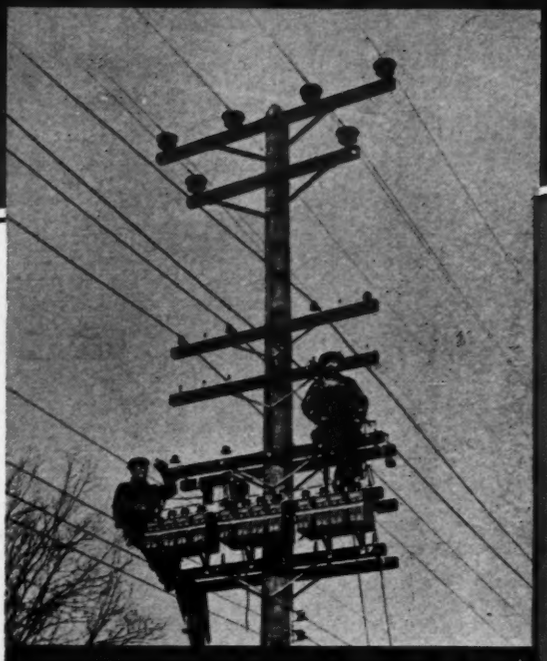
HOMELITE CORPORATION

PORT CHESTER, NEW YORK

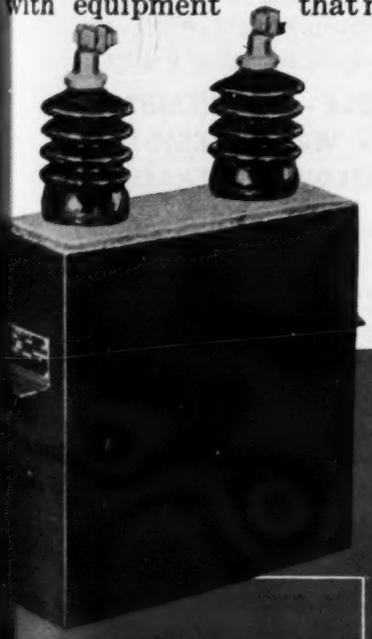
INCREASE LOAD CAPACITY OF YOUR SYSTEM WITH

CORNELL-DUBILIER CAPACITORS

Meet that emergency of "more load" with C-D capacitors. They give needed capacity now and will improve your system for all time . . . . . with equipment that never will be obsolete. C-D capacitor specialists, located in principal cities will be glad to give you full information. Cornell-Dubilier Electric Corporation, So. Plainfield, N. J.



Installing a 180 KVA Bank of C-D Capacitors



Individual outdoor capacitor 15 KVA, 2400 Volt, Single Phase, 60 cycles

Easy to Install C-D capacitors can be grouped on poles at low voltage points on the line. They use a minimum of critical man-hours and materials.

C-D Quality Points Double-sealed extra sturdy bushings. Heavy gauge, all welded steel case. Extra rugged connectors. Made by specialists; men who design and build capacitors exclusively . . . in six great factories.

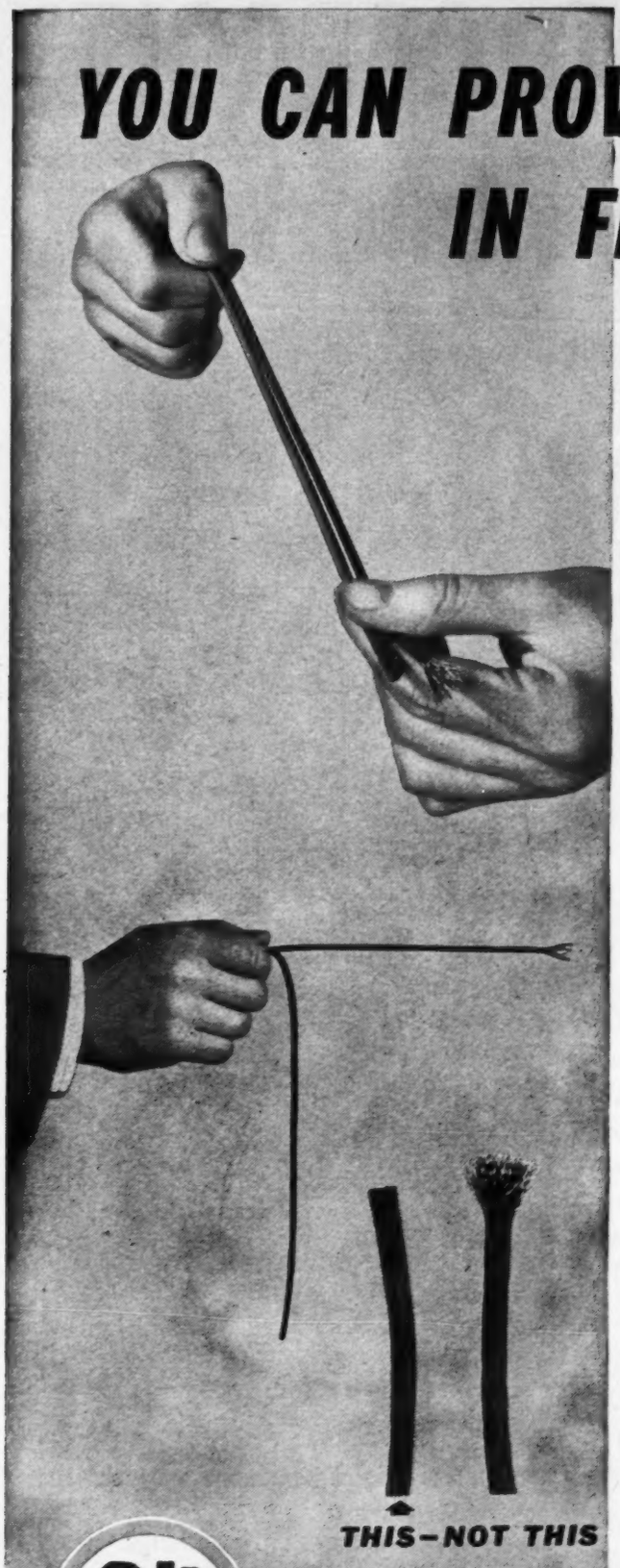
Cornell-Dubilier capacitors

FOR POWER FACTOR IMPROVEMENT
CARRIER CURRENT COUPLING
SURGE PROTECTION

1918 1944

Reg. U. S. Pat. Off.

YOU CAN PROVE TO YOURSELF IN FIVE SECONDS...



That new BH Fiberglas "extra Flex" Sleeving is more flexible than saturated sleeving

WE'VE TOLD YOU about the non-fraying quality of the new BH Sleeving. But don't forget the extra flexibility we've built into it. You can prove this to yourself with the five-second test of sleeving flexibility:

Obtain from us a sample of BH Extra Flexible Fiberglas Sleeving equal in size to the saturated sleeving you use now.

Following Figure 1, hold eight-inch lengths of both BH Extra Flexible Fiberglas Sleeving and saturated sleeving between the thumbs and fingers of both hands. Stretch both sleevings to make them straight.

Now release the sleeving ends held in your left hand. Instantly, the new BH Fiberglas Sleeving will fall limp, proving its extra flexibility. The saturated sleeving will remain straight, practically inflexible. The comparison is shown in Figure 2.

NON-FRAYING • FLEXIBLE • HEAT-RESISTANT
NON-INFLAMMABLE • WATER-RESISTANT
NON-CRYSTALLIZING at LOW TEMPERATURES

The new BH Extra Flexible Fiberglas Sleeving is woven from the choicest continuous-filament Fiberglas yarns. It possesses high dielectric strength, is water-resistant and, like all BH Sleeving and Tubing—is non-inflammable.

All sizes from No. 20 to 5/8", inclusive, are available. Write for samples of this radically new and different sleeving today—in the sizes you desire. Seeing is believing! Bentley, Harris Manufacturing Co., Dept. W, Conshohocken, Pa.

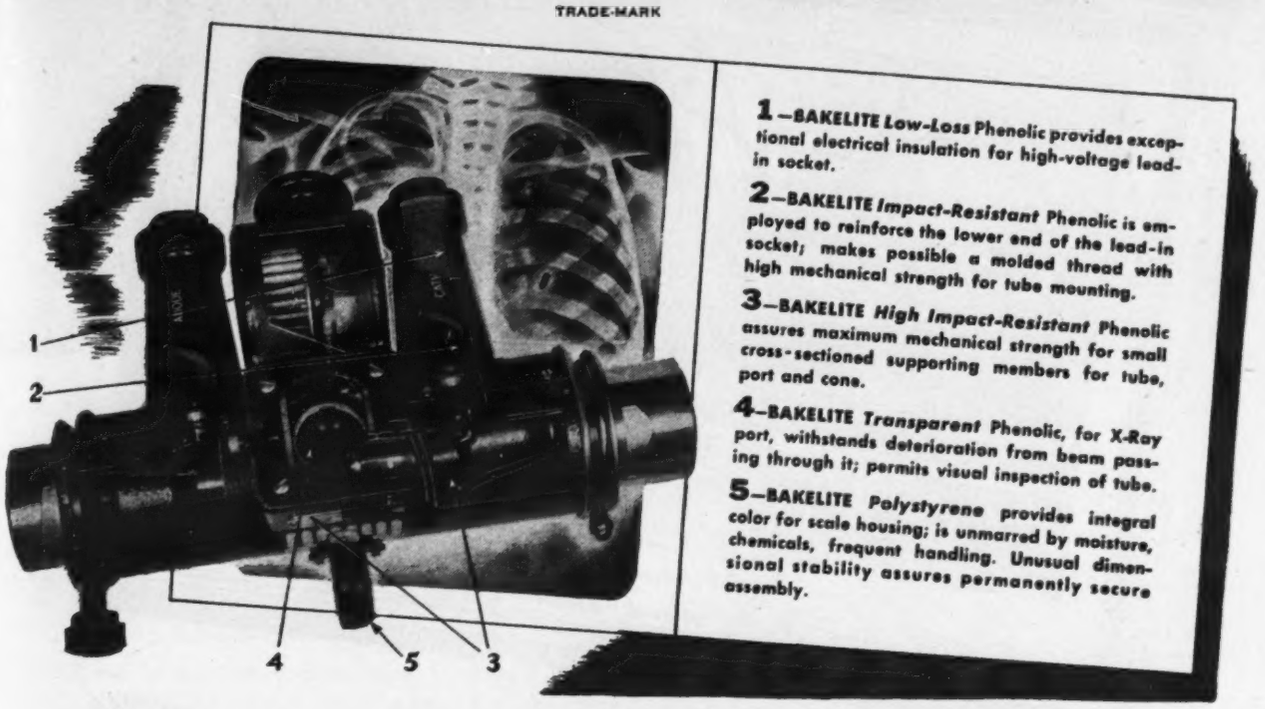
BH PRODUCTS

NON-BURNING IMPREGNATED MAGNETO TUBING • NON-BURNING FLEXIBLE VARNISHED TUBING • SATURATED AND NON-SATURATED SLEEVING

BENTLEY, HARRIS MANUFACTURING CO.
Conshohocken, Penna.

BAKELITE

TRADE-MARK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5
3
1—BAKELITE Low-Loss Phenolic provides exceptional electrical insulation for high-voltage lead-in socket.
2—BAKELITE Impact-Resistant Phenolic is employed to reinforce the lower end of the lead-in socket; makes possible a molded thread with high mechanical strength for tube mounting.
3—BAKELITE High Impact-Resistant Phenolic assures maximum mechanical strength for small cross-sectioned supporting members for tube, port and cone.
4—BAKELITE Transparent Phenolic, for X-Ray port, withstands deterioration from beam passing through it; permits visual inspection of tube.
5—BAKELITE Polystyrene provides integral color for scale housing; is unmarred by moisture, chemicals, frequent handling. Unusual dimensional stability assures permanently secure assembly.

FIVE DIFFERENT PLASTICS *SO THAT HIGH-VOLTAGE X RAY CAN SAVE SOLDIERS' LIVES*

The manufacture of this X-Ray tubehead called for the solution of many problems involving other than electrical properties. In addition to high voltage, the problems of deterioration from X Rays, of impact and vibration, temperature extremes, corrosion and transparency had to be solved—in a product whose complex parts must be made at high speed.

For the parts indicated above, the right BAKELITE Plastic solved each problem in turn. The tubehead, part of a mobile unit made by Picker X-Ray Corporation, New York, for the armed forces, is literally a "miniature catalog" of BAKELITE Plastics, each carefully selected for its individual properties—and adaptable to extremely rapid fabrication into finished parts.

A thorough knowledge of BAKELITE Molding Plastics will show you that there is a right plastic for every electrical application. Close teamwork of manufacturer, fabricator, and BAKELITE Plastics Headquarters will eliminate errors and save valuable time. Let our Field Engineers work with you on your essential products, or write for Booklet 47-M.

BAKELITE CORPORATION, 30 E. 42 St., New York 17

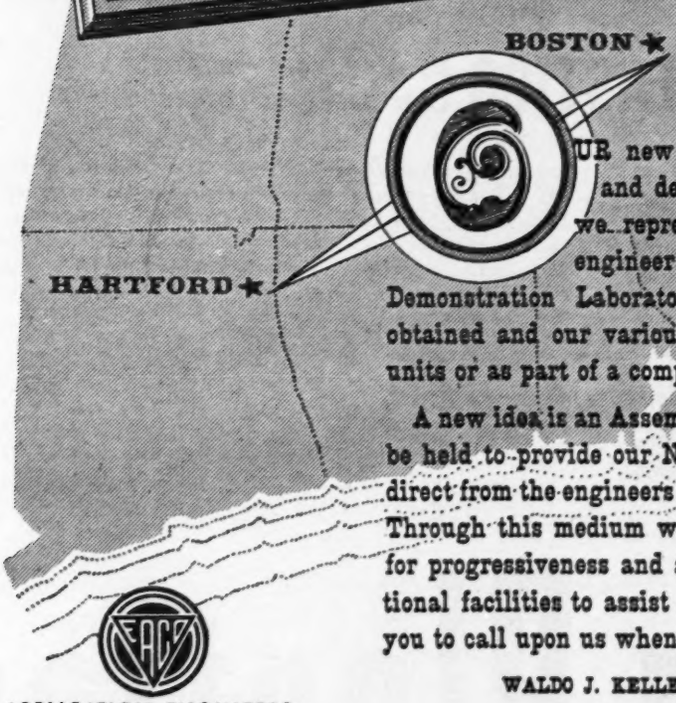
Unit of Union Carbide and Carbon Corporation

UCC

Molding Plastics

News from NEW ENGLAND

New Home of Electrical Apparatus Company
1200 Soldiers Field Road, Boston 34, Massachusetts



OUR new quarters include complete facilities for the sale and demonstration of the products of the manufacturers we represent exclusively in New England. A qualified engineer is in charge of a new, larger, fully equipped Demonstration Laboratory. Here full engineering information can be obtained and our various electrical products can be seen in operation as units or as part of a complete control system.

A new idea is an Assembly Hall where electrical engineering meetings can be held to provide our New England customers with the latest information direct from the engineers and executives of the manufacturers we represent. Through this medium we are keeping pace with New England's tradition for progressiveness and are providing, at a time when most needed, additional facilities to assist our customers. We extend a cordial invitation to you to call upon us whenever we can be of assistance.

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ELECTRONIC CONTROLS • AUTOMATIC PRODUCTION GAUGES

ELECTRICAL APPARATUS COMPANY

1200 SOLDIERS FIELD ROAD, BOSTON 34, MASSACHUSETTS

1 SAVES COST OF METAL DIES

Compound curvatures and fairly sharp bends without any inside radius are produced in PANELYTE #906 parts by inexpensive forming dies of Kirksite, cast phenolic, laminated phenolic or hardwood.

2 SIMPLIFIES AND SPEEDS PROCESSING PANELYTE

#906 can be stamped, bent or drawn in process similar to—but much simpler than metal stamping. No need for hot molds. Material is merely heated to temperatures higher than those used in manufacture, molded, and left for very short period in mold for partial cooling.

3 ELIMINATES NEED FOR HEAVY EQUIPMENT OR HIGH PRESSURES

The fast and economical forming of PANELYTE #906 is accomplished with small air cylinders — and, in some cases, hand presses can be efficiently used.

If you manufacture or use laminated phenolic parts of complex design, Grade 906 PANELYTE may save you time — and money. This fully cured thermo-setting sheet plastic opens entirely new fields in plastic fabrication. Write for Engineering Bulletins on Grade 906 . . . and samples.

PANELYTE *the structural plastic*

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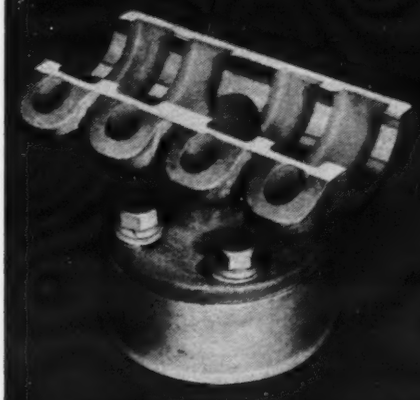
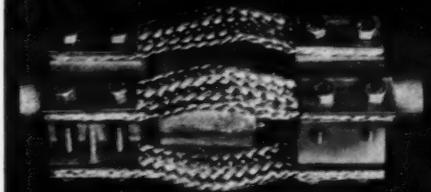
These BUS FITTINGS Last a Substation Lifetime





PACIFIC ELECTRIC builds them of Special Copper Alloy for . . . GREATER RESISTANCE TO ATMOSPHERIC CONDITIONS

To last a substation lifetime—

Pacific Electric bus fittings made in all sizes and types, are built of special copper alloy developed for greater resistance to atmospheric conditions. Their well-matched sections are easy to install and assure full current-carrying ability, while their ample mechanical strength offers greatest of safety.

Where bus fittings are not made of alloys resistant to atmospheric resistance, pitting may occur, resulting in loss of current-carrying capacity, mechanical weakness and outages.

To assure long reliable service ask for details on Pacific Electric bus fittings—their special alloy which resists pitting, offers full current-carrying; the well-matched sections for easy installation.

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G. B. Kirkwood
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90 West St.
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Pacific Electric Mfg. Corporation

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WHAT EQUIPMENT IS NEEDED FOR ELECTRONIC HEATING?

HERE'S SIMPLIFIED INFORMATION BASED ON YOUR QUESTIONS

Many questions about electronic heating of *non-metals* come to the attention of RCA engineers. A few, dealing with equipment, are summarized and answered briefly below.

Q. What equipment is needed for an electronic heating installation?

A. Briefly: an electronic generator, a "load-tuning" unit, and the electrodes. (See Fig. 1.) In some cases, special high-frequency transmission line is required to carry power from the generator to the electrodes if the distance is more than a few feet.

Q. What are the functions of these units?

A. The *electronic generator* (see Fig. 2) converts power from the 60-cycle power line to high-frequency power. This is done by means of electron tubes and associated equipment. The load-tuning unit is a device which electrically "gears" the high-frequency power to the load. In a sense it corresponds to the transmission in an automobile. The electrodes are the means of applying power to the load; they usually consist of two flat plates. The work is placed between them.

Q. How does the electronic generator work?

A. Fig. 2 shows a simplified diagram of the electronic generator. The *oscillator* is an electrical circuit containing one or more large electron tubes. These tubes and the circuit components convert high-voltage d-c (supplied by the transformer and rectifier) to high-frequency alternating current (frequencies up to 20 million cycles per second or more are not uncommon). There are no moving parts, of course. The efficiency is usually 50% to 75%. In some cases the high-voltage transformer is mounted outside the generator cabinet.

Q. Do tubes last very long?

A. Yes. A good average figure is 5,000 hours of operation. Many tubes give much longer service when operated with ordinary care.

Q. Is equipment available?

A. Yes. RCA can supply—on priority—standard electronic heating equipment rated at up to 100-kw. output (340,000 BTU per hour). Descriptive bulletins are available on request (see coupon).

Q. What materials can be heated?

A. Many non-metallic materials can be economically heated by electronic means. For example: wood, rubber, plastics, resins, chemicals, glass, ceramics, foods, textiles, paper. (Metals can also be heated electronically, but are not considered in this discussion.)

Q. Is the equipment hard to operate?

A. No. Once the process has been "set up," any intelligent worker can operate the equipment without difficulty.

Q. How is equipment maintained?

A. The RCA Service Company makes regular inspections of RCA installations on a yearly contract basis. Tube replacement is included in the contract.

For further information, address: RCA, Electronic Apparatus Section (70-46F), Camden, N. J.

LISTEN TO *"The Music America Loves Best" on the RCA program every Saturday, 7:30 P.M., E.W.T., Blue Network*

★ BACK THE ATTACK . . . BUY MORE THAN BEFORE

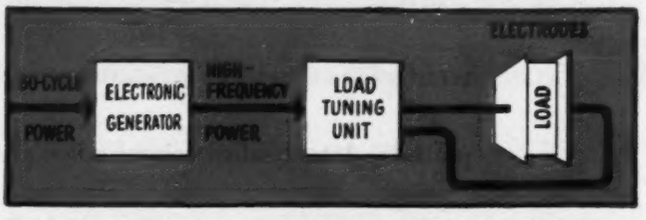

Fig. 1. Elements of an electronic heating installation. Standard 60-cycle power is converted by electron tubes to high-frequency (radio-frequency) power for heating.

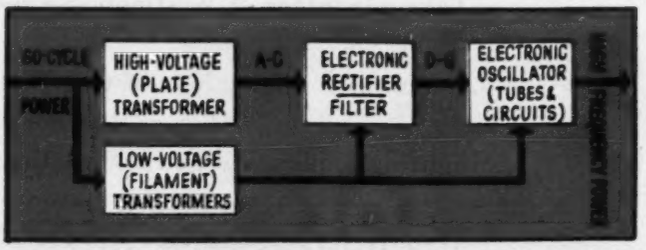

Fig. 2. Simplified block diagram of an electronic generator. In large units, the transformer is located outside the generator enclosure.

RCA ELECTRONIC HEAT

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION • CAMDEN, N. J.

LEADS THE WAY . . *In Radio . . Television . Tubes . . Phonographs . . Records . . Electronics*

SEND THIS TODAY! RCA, Electronic Apparatus, Section, Camden, N. J.

Please send me the booklets checked, which tell more about economical electronic heating.

- ☐ "Heating Wood with Radio-Frequency Power"
- ☐ "R-F Heating Speeds Plastic Molding"
- ☐ "RCA Electronic Generator 15-B"

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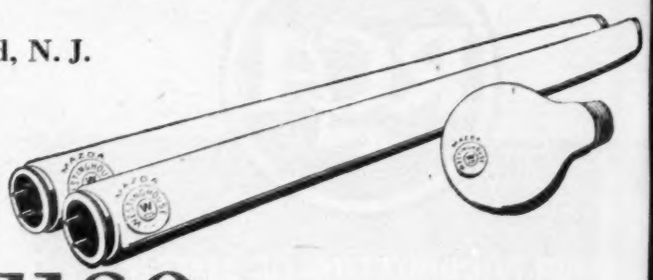
a job for unerring eyes

Unbelievably, American and Canadian drug manufacturers have raised the rate of Penicillin production to *one hundred times* the output twelve months ago. In this amazing record the See-ability made possible by today's high-efficiency Westinghouse Mazda Lamps has played an active role. For in Penicillin culture technicians must measure and weigh minute quantities, compare sample compounds, detect infinitesimal color gradations . . . all vital close-seeing operations where See-ability means better concentration and faster, more accurate work. Take advantage of Westinghouse research and engineering progress—recommend bright, long-lasting Westinghouse Mazda Lamps for every lighting application and installation. Westinghouse Electric & Manufacturing Company, Bloomfield, N. J.



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WESTINGHOUSE PRESENTS JOHN CHARLES THOMAS • SUNDAY 2:30 EWT., N.B.C. • "TOP OF THE EVENING" • MON. WED. FRI. 10:15 EWT., BLUE NET.

ON GUARD! Standing like sentinels over high-voltage power lines, 14-ft. condenser bushings atop giant Westinghouse Oil Circuit Breakers protect many of the electrical distribution systems of wartime America.

It is just as necessary to protect the bearings in turbo-generators. Right here is where effective lubrication can help . . . lubrication with *Texaco Regal Oil.*

Texaco Regal Oils (R & O), a new high in the prevention of rust and oxidation, keep steam turbine systems clean, bearing temperatures normal, governor action smooth and sensitive. These Oils free themselves rapidly from air and water, are highly resistant to gum formation and sludging.

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Texaco Lubrication Engineering Service is available to you through more than 2300 Texaco distributing points in the 48 States.

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The Texas Company, 135 East 42nd Street, New York 17, N. Y.

THEY PREFER TEXACO

★ *More revenue airline miles in the U. S. are flown with Texaco than with any other brand.*

★ *More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.*

★ *More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.*

★ *More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.*

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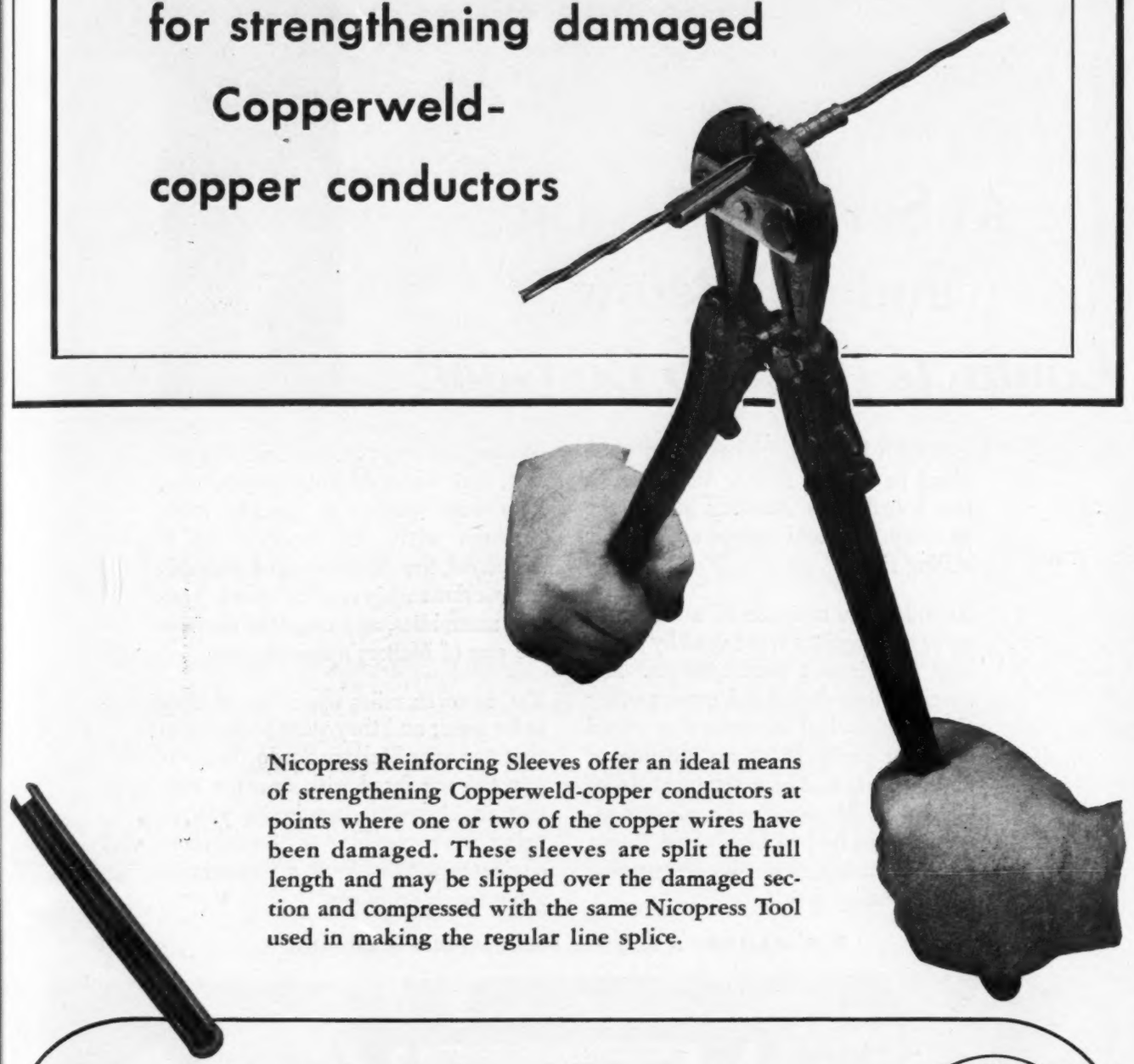
TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

Nicopress REINFORCING SLEEVES

for strengthening damaged Copperweld-copper conductors



Nicopress Reinforcing Sleeves offer an ideal means of strengthening Copperweld-copper conductors at points where one or two of the copper wires have been damaged. These sleeves are split the full length and may be slipped over the damaged section and compressed with the same Nicopress Tool used in making the regular line splice.

The National Telephone Supply Company

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Canadian Mfr.—N. SLATER CO., LTD., HAMILTON, ONT., CANADA

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THE NATIONAL TELEPHONE SUPPLY COMPANY

At Seven Miles Up and 60° Below

Contacts Have to Be Good

Up, up a little bit higher—that's the trend in combat flying. And up with the trend goes Mallory skill—the capacity to build *better* as the air ceiling rises.

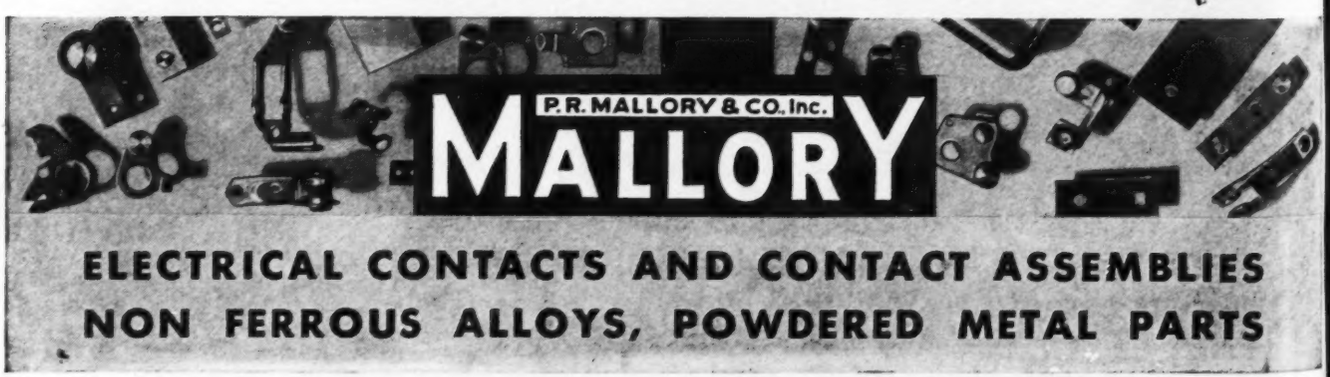
Recently the aptitude of a manufacturer of magnetos was tested by a new high in aircraft requirements. The specifications demanded among other things, electrical contacts that would function perfectly at an altitude of 35,000 feet, and at a temperature of 60° below. Moreover, the contact assembly arm had to be molded into a plastic housing, thereby necessitating a high quality finish.

Military secrecy shrouds the full problem, but when Mallory engineering help was sought, it quickly came through with the answer. As it happened, the solution called for skillful workmanship on tungsten contact assemblies, and tungsten contacts are one of Mallory's specialties!

Yes, at seven miles up, contacts have to be *good;* and they were better than that the way Mallory made them. If you too are faced with unusual contact requirements, we invite you to bring your troubles to these same engineers who make it a business to solve tough problems.

Serve Your Nation, Save for Yourself —Buy War Bonds!

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA



ECONOMY, CONVENIENCE, AND SPEED

are built directly, simply, and sturdily into SHAWMUT SHUR-LAG RENEWABLE FUSES and LINKS. You can replace the link in a SHUR-LAG fuse in a matter of seconds, and be in circuit again; and a SHUR-LAG fuse will give you full protection at all times. Use SHAWMUT SHUR-LAG RENEWABLE FUSES and LINKS, and get rid of fuse trouble for good, as so many others have. Our Bulletin 400 will tell you all about it.

Fuse makers *since 1893*

The Chase-Shawmut Company
Newburyport, Massachusetts

JUST SUPPOSE!

by Barbara Brown

Olney High School, Philadelphia, Pa.

Note: Several weeks ago, the United States Treasury Department and the Columbia Scholastic Press Association sponsored an editorial contest for the nation's high school students. Subject: War Bonds. Winner: 15-year-old Barbara Brown, a Philadelphia high school junior. In the interests of helping the Fifth War Loan Drive, now in progress, we are proud to print here the stirring message written by Miss Brown.

SUPPOSE *there were no tomorrows?* . . . Think about it for just a minute . . . No tomorrow for you, or your kid sister at home—or the brother who left for the Army yesterday. Did you ever think that we, who have had so few yesterdays, may have no tomorrows?

It *has* happened, you know. To Jack Feldman, and to Bob Ernest—and to fifteen other boys who sat in our classes just last year . . .

They will have no tomorrows. They died before they ever had a try at living . . . so that we here at home might have our chance.

There are millions who were asked to give up more than a double feature at the Earle . . . or a spiffy new pair of pumps for next week's formal. A soda is a pretty insignificant sacrifice, when you think of things like—

The kids in Russia, who live on a few ounces of cereal a day. *They've never seen an ice-cream soda.*

The Polish boys and girls, who would be in school right now, just as we are . . . *if there were any schools left.*

The French youths who've never had a hamburger when they were out on a date—or any other time, for that matter. They are old, very old . . . *older than you and I will ever be. . .*

There are millions of them . . . in Norway . . . Holland . . . Denmark . . . Belgium . . . They would stare in amazement if they could be here to see—

A jalopy painted bright yellow. "The Tin You Love To Touch" printed in big, green letters on the back.

A high school senior, uncomfortable in his first tuxedo . . . calling for his date, looking nervous.

Millions of things that we take for granted . . .

There is such a feeling of permanency in our tight little world. We'll go to school with the gang, today . . . and tomorrow . . .

BUT, WHAT IF THERE WERE NO TOMORROWS? There's only one way to be sure, you know—

Buy War Bonds . . . That's a simple little phrase. It's the American way of saying what we mean in a few direct words. *Buy War Bonds.*

Yes—you and everybody must buy War Bonds. We've *got to* buy more and more and more of 'em. Just get the idea into your head that your $18.75 might—just *might* end the war one-fifth of a second sooner. That maybe, in that one-fifth of a second, the boy next door could be on the receiving end of a bullet . . . Then you'll know that it's worth any small sacrifice you have to make!

We've got to keep on plugging, saving, convincing. Giving our pin money . . .

Tell everybody—sell everybody! We can't take no for an answer . . . Because we are buying *tomorrow—and tomorrow—and tomorrow.*

SPANG-CHALFANT

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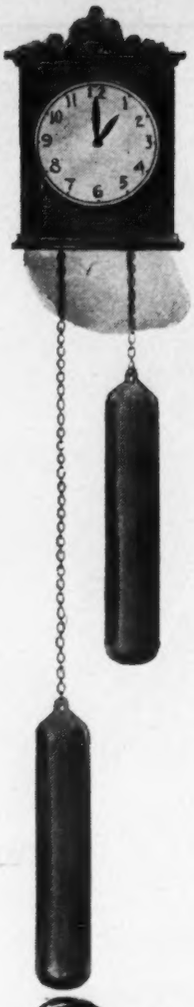

"I think I'd better stop now"

When Long Distance Says—

"Please limit your call to 5 minutes"

That's a good suggestion to follow. It means the lines to war-busy centers are crowded. It's a friendly, thoughtful act that helps the other fellow—and then some day turns right around and helps you.

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WHEREVER WIRING APPLICATIONS are exposed to conditions which ordinarily cause electro-chemical corrosion, Lumarith (cellulose acetate) insulation is particularly desirable. Guarded by Lumarith even hair-like copper wire shows no more corrosion than when suspended in free air.

Lumarith has excellent dielectric strength. A new development—a special matte-finish—needs no lubrication and allows more elongation, a big plus in winding production.

Film . . . Foil . . . Molding material and other forms

It's really exciting news, Lumarith. Send for special new booklet packed with potent facts: "Lumarith for the Electrical Industry." Celanese Celluloid Corporation, The First Name in Plastics, a division of Celanese Corporation of America, 180 Madison Avenue, New York City 16.

LUMARITH*
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*Reg. U. S. Pat. Off.

Want to move 35 Tons?

Even this small actuator weighing but 3.3 pounds can move 1200 pounds.

WE wouldn't tell you how fast America's fighting planes go. That's a military secret.

But we've all read it's well over 300 miles an hour.

We've read too how they hit 700 or 800 miles an hour in dives. And how paint was peeled by the air pressure.

Did you ever stop to think that the plane's flaps and controls have to work surely, smoothly and dependably against pressures like that?

It's done by such mechanisms as you see in the picture.

They are called Lear Actuators.

They are powerful. Some can push up to 75,000 pounds.

They are light. That's a "must" in aircraft.

They are small. They have to fit in available space.

A good many preconceived notions had to go by the board to meet all these requirements. For example, the little electric motor that runs them is full of revolutionary engineering refinements.

Every man and every minute we have now can't make all the motors and actuators that we would like to deliver for Uncle Sam's aircraft.

But the day is coming when they will have different jobs to do. New jobs on peacetime products—perhaps like steering ocean liners, or parking cars, or things we've never thought of.

That is one reason for this advertisement. We want to know who can use an actuator or a motor like these.

Another reason is, we want you to know that there is available the kind of thinking and engineering which have produced these and some 250 other Lear products.

LEAR AVIA INC.
PIQUA • OHIO

THERE is no such thing as a "cure-all" brush for fractional h.p. motor problems.

That's the big point about small, universal-motor problems in general. They're as alike as peas in a pod—*which means they're not alike at all.* They only seem alike superficially, and that's why brush problems begin to pile up.

This becomes more understandable when it is realized that a brush which works best on one make of, say, vacuum cleaner, probably won't work best on another. There are too many points of difference requiring painstaking research and testing to uncover. Moreover, this work must be based on the specific application involved, with full details at hand, and backed by a COMPLETE line of brush types permitting adaptations to any one of hundreds of widely varying conditions that may be indicated.

Stackpole's facilities in this direction are entirely adequate, our record of achievement in solving small-motor brush problems is unsurpassed.

We'll gladly place these facilities at your disposal in meeting either present or post-war brush requirements.

STACKPOLE CARBON COMPANY, ST. MARYS, PENNA.

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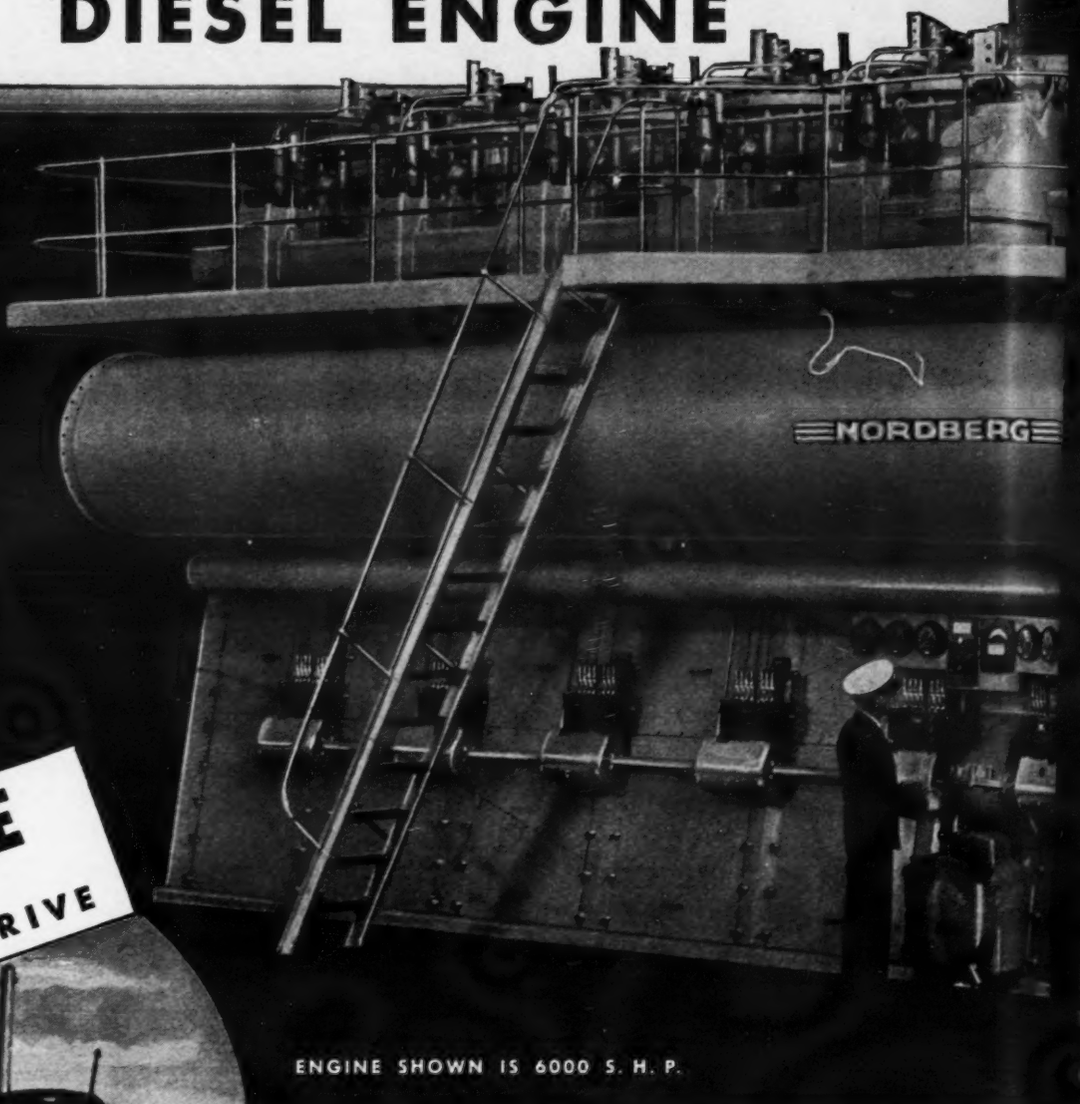
ELECTRICAL BRUSHES AND CONTACTS (*All carbon, graphite, metal, and composition types*) • RARE METAL CONTACTS • WELDING RODS, ELECTRODES, AND PLATES • BRAZING BLOCKS • RHEOSTAT PLATES AND DISCS • PACKING, PISTON, AND SEAL RINGS • CARBON REGULATOR DISCS • SINTERED IRON COMPONENTS • CARBON PIPE, ETC.

AMERICA'S MOST POWERFUL
SINGLE ACTING
DIESEL ENGINE



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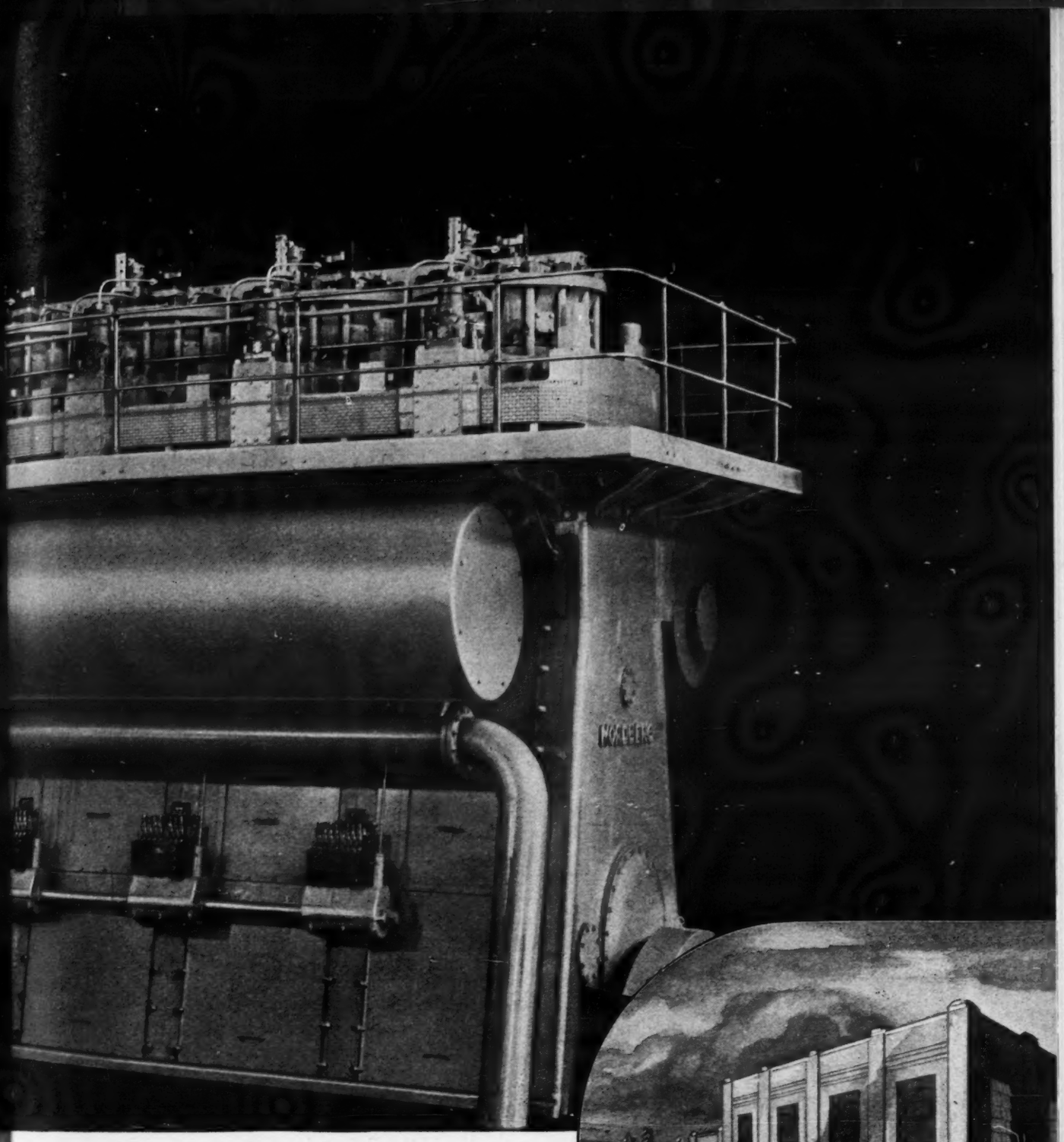

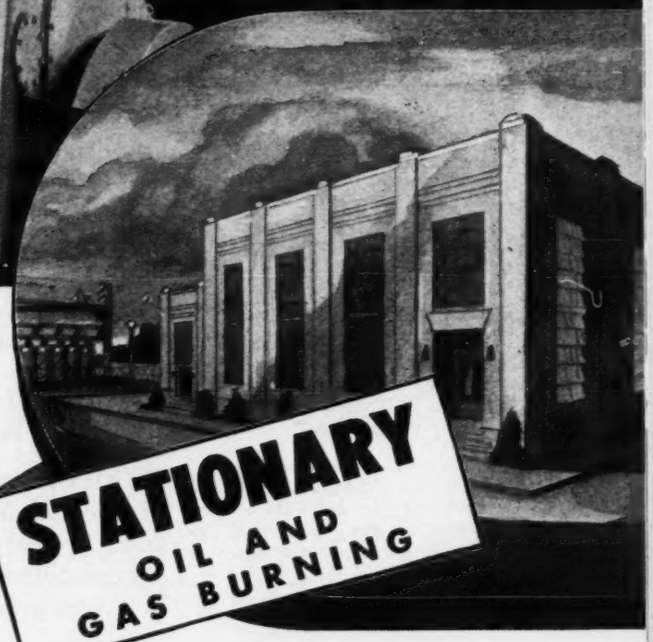

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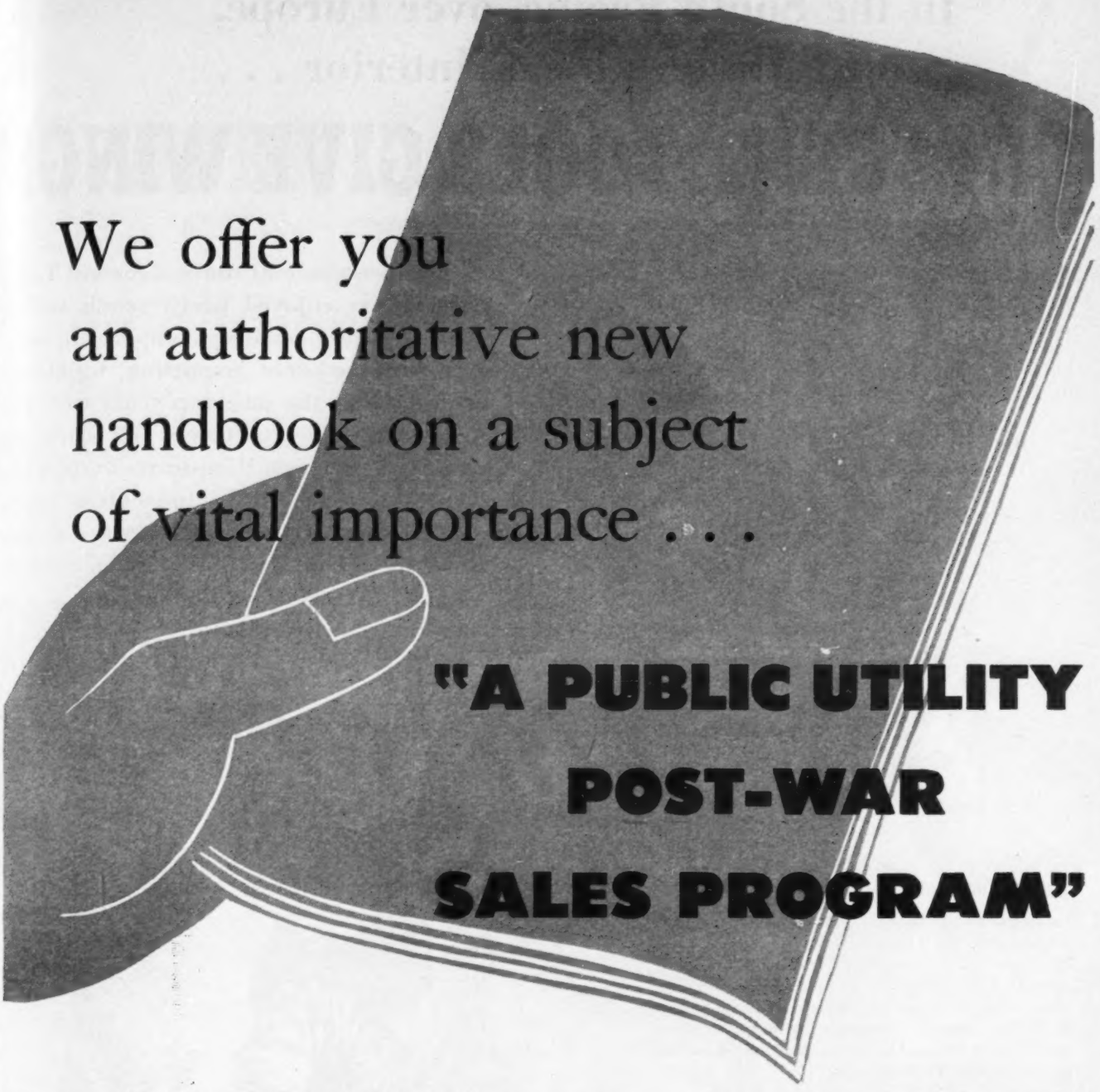

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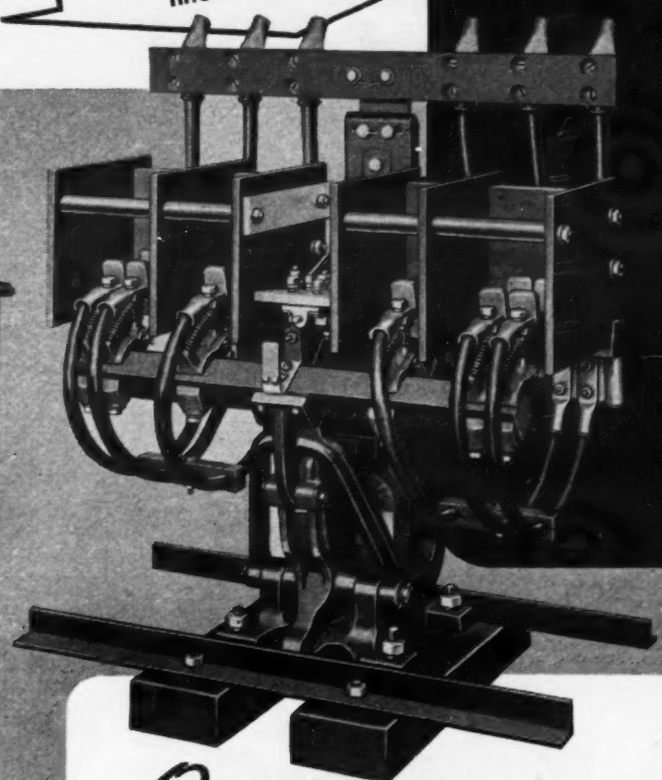

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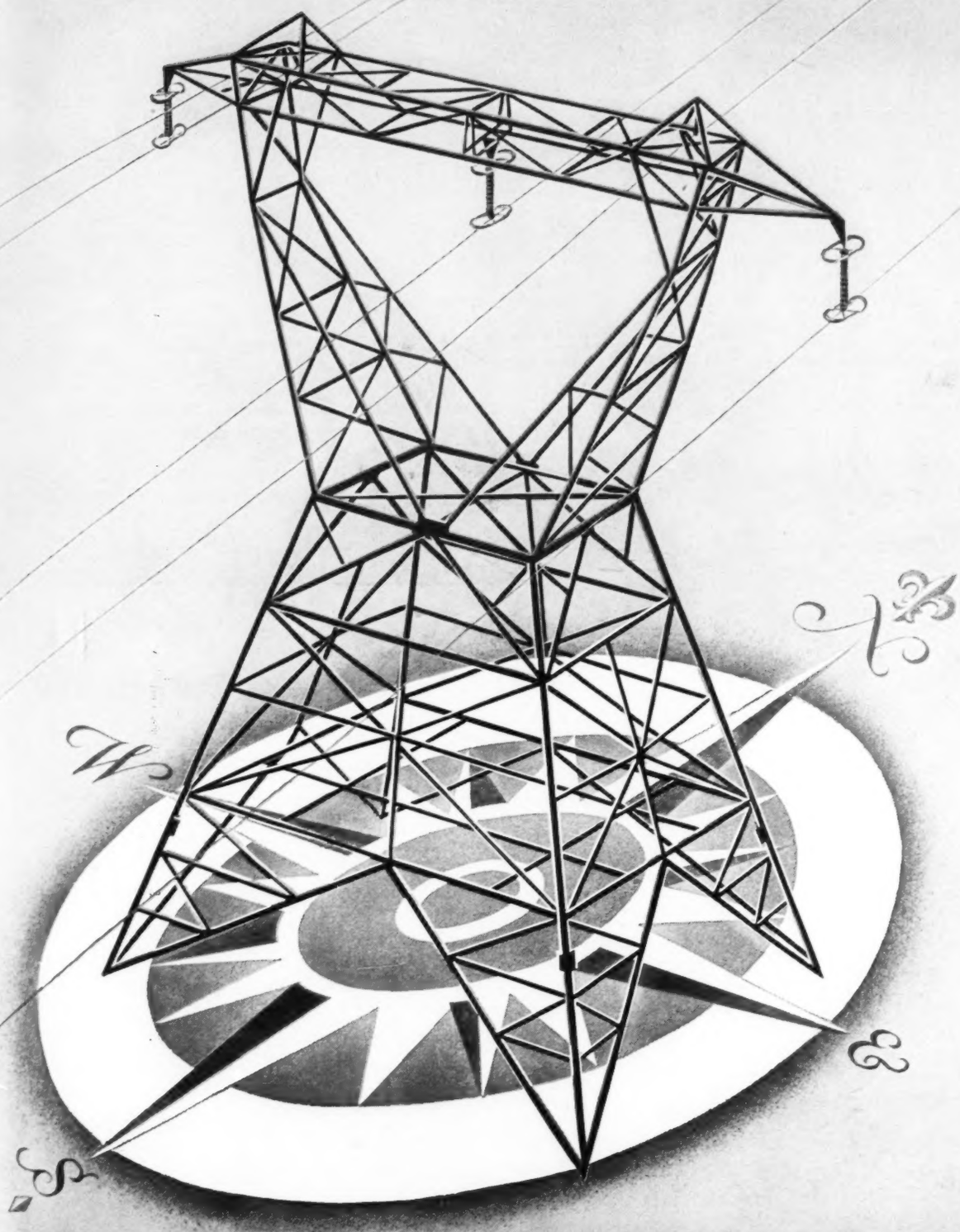

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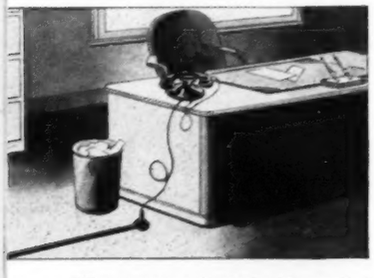

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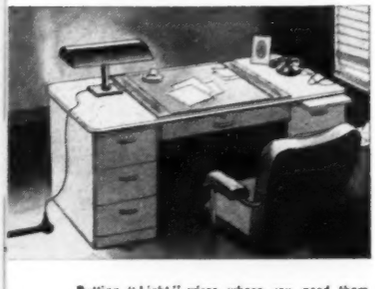

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National Electric Products Corp.

Pittsburgh, Pennsylvania

Electrical World
JUNE 10, 1944

Statesmanship

THREE YEARS AGO the Edison Electric Institute held a convention at Buffalo which we said at the time marked the low point in the swing of the pendulum of the electric utility industry. At that time the industry had no program, no objective, no leadership. It was punch drunk from a constant pummeling and its arms were down.

There has been no convention since that time—only one day meetings devoid for the most part of inspiration—until this year when in New York an industry was reconceived if not reborn.

The reports which occupy the following pages are evidence of a condition totally different from that of three years ago. Where then there was no admitted future, today executives are making plans. Where then all was gloom, today there is the sunrise of new opportunities.

Three years ago SEC was just beginning to get tough in the dismemberment of holding companies and because so much of the direction of the industry, at least in its association work, had come from the holding companies the industry itself was beginning to split up. Since that time, however, the operating company executives have gradually taken more of the initiative.

In order to get things done they contributed further to the general disorganization by forming new groups every time a new job arose. In some ways this confusion of associations has been of real service to the industry because it has shown so clearly the great need for unity and leadership.

In fact, the convention authorized the appointment of an E.E.I. committee to act with similar committees from the other three organizations—Association of Edison Illuminating Companies, Council of Electric Operating Companies and the national advertising group—to study ways to bring about unification.

This and other actions this week at the E.E.I. convention gave greater semblance of an industry of concurring minds than has been apparent for several years. Most of the speakers were once more from within the industry and they were presenting plans and ideas that would make the industry strong.

Thinking of this kind is what is needed to make a cohesive industry because it is creative. One doesn't build without faith and faith is the inspiration that has too long been lacking in the electric utility industry.

The weakness of the industry all along has not been the strength of the foe but its own lack of faith and its fear to do anything lest it be slapped down. Now once more it has found men who will lift their heads and look to tomorrow with eagerness in place of dread—men who believe that there is a future in this country for privately operated electric utilities.

Let it not be thought, however, that the convention this week was evangelistic. There was no exhorting. It was a practical appraisal of ways to cut costs and to build profitable load. It was a fearless recognition of certain problems, such as labor and rural electrification, with realistic recommendations. It was a well balanced package of business statesmanship.

Perhaps this is the beginning of a reunited industry—reunited through the inspiration of a job to be done, of an objective. We hope so.

Planning for Economies in System Costs

Analysis of outage data indicates system elements in which economies should be sought — Experience with war loads suggests possible revisions of former ideas of equipment capabilities — Watch costs per peak kilowatt as significant indexes

S. M. DEAN, Chief Engineer of the System, The Detroit Edison Co.*

TODAY the tools and methods to deal with load are very largely available. It is no longer a question of whether we can produce the physical equipment to meet the demand, but rather how to do it at a lower cost in the face of the rising cost of the component parts which we must use. It is to this latter field of application engineering that we must now address our attention.

Manufacturing companies that regularly do business in highly competitive markets first determine the type and quality of product they must have to attract the customer, and they next set the price at which they think they can sell it in competition. This bogey is then turned over to the designer and the producer. These latter often squirm under the pressure, but when the problem is defined, they somehow find a way to meet it. That is the mechanism of progress.

Service Continuity

Using that approach we must first re-examine the actual needs of our business and estimate the price at which we shall have to sell our service to make ends meet. We shall then be in position to use our wits to accomplish that result with the minimum cost in equipment and personnel.

Examination of the operating record of a system shows surprisingly good service continuity.

Consider the number of interruptions per year experienced by the average customer in the several areas of our system. The interruptions are classified by causes, and the average duration from each of the several causes is calculated. Short interruptions, where service is restored in a minute or two by the reclosing of a circuit breaker, are not included.

One group of data shows the interruption record for a large city having multiple underground transmission and mainly overhead distribution.

On the average, there is only one interruption of consequence in four and one-half years from all causes, including the customer's own equipment. The average duration of outage is only fifty-eight minutes which means that we give service 99.997 percent of the time. Also there is only one outage in nine years chargeable to the power company. That represents the quality of service that can be rendered to metropolitan customers when served almost entirely by overhead distribution lines; that is, without resort to duplication of lines.

Another group of data illustrates the service continuity in the larger outlying cities served by several overhead transmission lines, sectionalized by local switching equipment, but where the use of primary rings and secondary banks on the distribution lines is not usually resorted to.

Considering all causes, there is an interruption to the average customer about every two years; and considering only causes chargeable to the power company there is an interruption once in two and one-half years. The average duration is about eighty minutes which means that we give service 99.994 percent of the time.

A third group illustrates rural areas served by several overhead transmission lines; a fourth, outlying towns served by a single "through" overhead transmission line; and a fifth, rural areas also served by a single "through" overhead transmission line.

Comparatively, the service in these later classes is less good than in the preceding ones. But, even in the worst case—the fifth group—our service is on 99.987 percent of the time.

Failures of bulk power supply are rare; but, when they do occur, they affect a large number of customers—hence, their importance. As one would expect, the chance for effective improvement is greatest in the field of distribution, and next in the field of transmission. Relatively inexpensive tools are at hand to improve the performance of both the distribution and transmission lines.

Reduced System Costs

Squarely opposed to the demand for increased reliability is the rising tide of system costs. The cost of everything that enters into the construction and operation of an electrical system is on the upgrade. However, there are some things that we can do about it.

First, examine our costs of doing business. Of our total operating costs, something approaching 60 percent is proportional to physical plant. Thus, if we can keep down the amount of physical plant required to serve a given load, we shall not only reduce our investment costs, but we shall also realize in time a substantial saving in operating costs.

*Abstract of paper to 1944 EEI annual meeting

What are the directions in which system savings can be made? Manifestly, the first step is to make maximum use of what we have. Really a small proportion of investment is affected by high loading. The following examples will illustrate.

There is about as much investment in conduit as in cable. The salvage value of the cable will perhaps average 35 percent of its first cost. Thus, the part of the total investment expendable by loading is only about 65 percent of the cable itself, or 32 percent of the conduit and cable investment. Manifestly, we can afford to expend the 35 percent fairly rapidly to avoid adding cables at 100 percent investment—provided that in overloading them we do not suddenly reduce their life to something approaching zero.

Cost of rewinding is small compared to the total investment involved in transformers, buildings, control accessories and the like; and again we can afford to expend the life of the insulation at a fairly high rate rather than install additional units. Fortunately, these devices are much more susceptible of inspection and temperature measurement than is the case with cable, and the hazard in high loading is therefore less. Further, there are new methods of auxiliary cooling for electrical equipment which will greatly enhance its load-carrying ability.

Standardization

Manufacturers are urging the users to agree on standardized designs for larger equipment. Our earlier experience with the standardization of smaller equipment shows in general, there have been two shortcomings. Too frequently users didn't buy the standard equipment, and there was little pressure from management to do so, particularly if it meant modifications of the user's current practices or involved any incidental cost increases. On the other hand, the manufacturers in many cases offered no price inducement to buy standard equipment as compared to equipment with special features desired by the particular user. In many cases the user suspected that the manufacturers priced the standard product to take the savings consequent on its adoption, and left the user only the "glory"; and the whole idea of standardization suffered thereby.

Users must make a real effort to agree on standard designs and then buy them. Top management will have to let it be known to their engineers and operators that they must show cause for not using standard equipment.

In this matter the interest of the manufacturer and the user are identical, and with proper executive support there appear to be worthwhile savings. The engineering side of standardization is well on its way, but the commercial side is lagging.

Savings in System Design

There are very real possibilities in the simplification of systems.

If the operating record of transmission lines were perfect, no switchgear would be needed. But when the lines have been sectionalized to the point where the reliability of the sections is sufficiently high, it is practicable to tap stepdown transformers off the lines without going to the expense of high-voltage switchgear. By the use of relatively inexpensive pole-top switches, line sectionalization can be accomplished.

Two large stepdown installations tapped off double-circuit steel tower lines of the 138-kv. class are already in operation on the Detroit Edison system. The lines are fairly long. In one case the distance between automatic circuit breakers is twenty-five miles, and in the other fifty miles. At present, the disconnecting devices for sectionalizing the lines are manually operated. The reliability of these installations has so far been very good, and, if they continue so, it is the intention to make considerable use of this type of installation in the future with consequent large savings.

Reliability of modern high-voltage cable approaches the reliability of the transformer. Its use as extended generator leads permits the connection of generator terminals directly to a bus at an intermediate switching center rather than to the power plant bus. This arrangement results in lower cost than that required where the output of the generator is transmitted from the power plant at lower voltage. It also has the advantage of reducing the short-circuit concentration at the power plant, and creates a simpler and more easily operated system.

For another example: The data on outages earlier discussed show the outage effect of wood-pole transmission lines on substations tapped onto them without the benefit of switchgear. If the line goes out of service, it takes the substation with it. On the average, these lines and substations account for an outage of forty minutes once in every two years. Fortunately, most of this outage occurs during daylight hours, usually late in the summer afternoon, and service is restored before darkness falls. While there are several available measures which might be applied, the most practical one is to sectionalize the line by installing reclosing pole-top switches on each side of the substation. These switches are designed to drop open when the line goes dead and reconnect the substation to whichever end of the line comes alive first. This method is applicable only to substations fed by through transmission lines; that is, lines fed from both ends. For single radial transmission lines, resort can be had to expulsion tubes for protection of the line.

Distribution lines are largely weatherproof wire and readily burn down under power arcs. However, there are switching devices being brought on the market capable of removing the fault current quickly enough to prevent the burn down of the line unless some foreign object is in contact with it to re-establish the fault. Another promising possibility which will be available after the war is low-cost primary wire of permanently high insulating value. Experimental installations show real promise.

Operating Savings

It has been common practice in the design of larger switching stations and in generating plants to base the layout on the best equipment arrangement and let the operator get around as best he can. On the other hand, some surprisingly low operating costs have been reported on generating plants designed to require a minimum of operators. This is an aspect of design which should not be overlooked.

Under war conditions, the investment per kilowatt of peak has gone to a new low. We hardly hope to keep it that low with the return of peacetime loads. However, if we use our ingenuity in the application of the means at hand and those forthcoming after the war, its progress should continue downward. We engineers have a job cut out for us and the most interesting part is yet to come.

Human Wants—Our Responsibility

As peoples' wants grow, they require increasing electric service, thus demanding lower costs and better performance in electricity supply

R. C. MUIR, Vice-President, General Electric Co.*

THE BASIS of any economic policy is the satisfaction of human wants. Throughout history the struggle of man has been to attain "Freedom from want of the esentials of life—food, clothing, and shelter." Technology has shown us the means to attain that freedom for all men and has further opened the path which leads to the satisfaction of want in the luxury classification, or a more abundant life.

In this country, we want new homes —1,000,000 or more per year for many years is a very conservative estimate. The average domestic consumer used 1,024 kw.-hr. in 1942. Today his annual rate of consumption is approximately 1,100 kw.-hr. A new all-electric home may easily use 5,000 kw.-hr. to 10.000 kw-hr. annually. The want is there—our problem is to satisfy it.

The Farmers' Wants

Much has been said about rural electrification, and over 40 percent of the farmers (2,600,000) in this country are using power line electric service. Another 2,000,000 want this service and our problem is to create wants to built up each individual farmer's load to a point where he can be economically served. This seems to be feasible. We should look upon each farm as; first, a residence and, second, a small industrial customer who produces food.

It is through industry that we satisfy our material wants, and we might say that industry creates our wealth and establishes our standard of living. The broad want of industry is anything that will increase the productive power of labor, which at the same time makes it possible for the individual to produce with less physical effort and under working conditions which are healthful and pleasant. The satisfaction of this broad want gives us an increase in real wages, which is a basic requirement of economic progress.

More Power to Industry

Specialization, science and engineering, and the abundant use of electric power are the main factors in the satisfaction of this broad want of industry.

In 1919 each man employed as a wage earner in our manufacturing industries had approximately 3 hp. of motors at his disposal. Twenty years later, just before the present war, this figure rose to 6½ hp., or the motor power per worker had more than doubled in 20 years. In 1939 our industries consumed 82 billion kw-hr. In 1943, only four years later, this consumption rose to 158½ billion kw.-hr. How much would our standard of living be raised if the same amount of energy were effectively used in a peacetime year? The process of electrification of industry is far from completed. We should expect a continuing growth of motor power per wage earner.

The placing of more electrical energy at the disposal of each workman is a matter of working out ingenious controls and machines and electrical processes to do things that were impossible with earlier equipment.

And what about the want of the electric power industry itself? It is tactically located in the key position; upon it practically all of our other activities depend.

The demands upon the electric power industry are for increasing service, more exacting service, at decreasing costs. And to meet this requirement, this industry will want all the help possible from the producers of power system equipment in terms of better performance and lower costs. Manufacturers of electrical equipment are keenly aware of this need for assistance and as in the past are dedicated to a broad and sustained development activity to this end.

One prominent utility executive stated he wanted a 9,000 B.t.u. per kilowatt-hour power station at $75 per kilowatt installed, and a distribution system with proportionate advantages. This is a worthy goal to try for, but high economy and low costs are not entirely compatible today.

The step from a 10,000 B.t.u. station to a 9,000 B.t.u. station is a big one. Higher steam temperatures, reheat and refinement in boiler and auxiliary design offer possibility of some improvement in the economy of the large coal burning steam station. Nine thousand B.t.u. is within the reach of the mercury steam cycle. The problem here is one of obtaining lower first costs, and we hope with experience this can be done. New cycles may develop in the future.

Wants of War First

For the past several years we have been devoting all of our energy, our science, our engineering and all the ingenuity we could command to satisfying the wants of our armed forces. We have done a magnificent job. Until the war is won, we must continue with that job, under the stimulation that the better our efforts, the sooner victory will come. With victory we shall find that science and engineering have advanced rapidly during the war period. We have built up a stockpile of new knowledge, new materials, new methods, new inventions, and know how, from which we can draw to build peacetime products. The wants for these products have been growing—the electrical industry is vital to their fulfillment. The future is fascinating for those who stand ready to serve.

* Abstract of paper to 1944 E.E.I. annual meeting.

Modern Equipment Reliability Affords System Savings

Simplification of substation designs is indicated possible because of progressive improvement in reliability of component equipments — Advances in power and distribution transformers

*A. C. MONTEITH, Westinghouse Electric & Manufacturing Co.**

THE ELECTRIC industry has established an enviable record in the way it has met the demands and requirements created by the impacts of war. Its performance has confounded its worst critics and surprised its staunchest supporters. But it must not rest long on these laurels. The hazards of complacency are well known. The mark of a healthy industry is its progressive growth. Precedents and customs which have reached the limits of their possibilities must be pruned out so that new growth can be stimulated by the light of new and changing conditions.

Coming of peace will bring many new problems to the electrical industry. They will be varied, but most of them will involve questions of economy in some form.

That costs have not decreased as rapidly as prices is somewhat distressing. There is serious trouble ahead if the trends continue. The conclusion is obvious—find methods of reducing costs. This is not easy, for reductions in cost must not be made at the expense of service reliability or by cashing some of the system reserves.

Any reduction in capital costs will also affect maintenance, taxes and other costs that determine the overall cost of production. This discussion will only cover capital costs. A few subjects might be:

1. Use equipment up to its highest economic limit of loading, especially for short-time overloads occurring frequently in case of emergency.

2. Provide wattless capacity at the loads to derive the greatest kilowatt system capacity per dollar of investment.

3. Encourage high load-factor loads, which result in a maximum number of kilowatt-hours for a given system investment.

4. Eliminate spare equipment, where the superior reliability of modern equipment with short-time load capacity or portable equipment can be used.

5. Encourage standardization of methods and equipment to minimize designs, drawings, tools, jigs and fixtures for heavy apparatus and in addition allow volume production when manufacturing the smaller apparatus.

6. Simplify system layout and reduce component parts of the system to a minimum. This is the subject that will be discussed in this paper.

Simplify System Layout

System layout should now be reviewed to take into account the improvements that have been made in apparatus and system designs to improve service reliability. Full advantage of improvements in equipment should be taken when plans for changes or extensions are made. This is such an important point, that, before examining specific possibilities, we should briefly review some of the advances that have been made in apparatus and system improvements in the past 20 years. It will be seen that in the last 20 years the reliability of equipment has materially improved so that it should be possible to modify our thinking in connection with the equipment that is put into systems and still maintain a high degree of reliability. Also, the pyramiding of probabilities should be eliminated where possible to minimize the amount of equipment necessary to secure a given reliability of operation.

Total outage factor for turbine generators has steadily decreased from 15.3 percent in 1922 to 6.11 percent in 1941, or maximum possible unit operation has steadily increased from 84.7 percent in 1922 to 93.86 percent in 1941.

All modern circuit breakers are now tested at full published kva. interrupting capacity in factory laboratories. Twenty years ago designs were based on a few field tests and experience.

High-voltage circuit breaker interrupting time has steadily decreased from about 25 cycles (1924) to 12 cycles (1929) to 8 cycles (1930) to 5 cycles for 115-kv. breakers and above; 3-cycle high-voltage breakers are available.

Breakers are now rated on a 15-second duty cycle and have relatively small derating factors for fast reclosing. This is possible because interruption is accomplished with only a fraction of the arc energy and consequent gas formation. Breakers 20 years ago were rated on a two-minute duty cycle.

High-voltage breakers can be built for reclosing in 20 cycles, a speed impossible only a few years ago. This permits economies in transmission line construction.

Modern circuit breakers meet the basic impulse levels. Their insulation can be coordinated with other apparatus on the power system so that uniform surge protection can be provided in the station.

Standardized metal-clad switchgear assemblies are now available utilizing

*Abstract of paper at annual meeting of Edison Electric Institute

modern breakers and incorporating safety features from an operating point of view that were difficult to get in the ordinary assembly of substations. Where concentration of power necessitates it, the equivalent of segregated phase in metal-clad switchgear can be obtained using only a small portion of the space required for the conventional segregated-phase switchgear. Bus runs are all insulated for full voltage. These bus runs have a practically perfect service record.

System relaying has been improved so that, in combination with the high-speed breakers, faults can be cleared in a few cycles instead of seconds as was the case 20 years ago. Over-all fault clearing times of as low as 4 cycles are possible. Fault clearing times of 6 to 9 cycles are common.

Outages Reduced Sharply

High-voltage outage-proof transmission lines are now in operation as a result of improvements in performance credited largely to lowering of tower-footing resistance, more adequate shielding, and coordinated tower designs. High-speed clearing of faults has reduced the burning, usually permitting immediate reclosure. Several lines have been in operation for 10 years with practically perfect operating record. Many lines, 66 kv. and above, have had an outage record of less than one per 100 miles per year. The outage factor of one 66-kv. line built in 1911 has been reduced from 45 outages per 100 miles per year to three simply by reducing tower footing resistance. A further reduction to one outage per 100 miles per year would result from adequate shielding.

Low-voltage outage-proof lines are possible through the use of protector tubes. In one case equipping 13.8-kv. lines with tubes every second pole on all three phases reduced outages from 42 to two per 100 miles per year.

Joints in high-voltage cable have been improved so that there are only approximately one-third the number of cable-joint failures in 1940 as in 1925, whereas in the cable itself, failures are only one-half as likely as in 1925.

Failures of network transformers per 100 banks per year have been reduced to 30 percent of those experienced in 1930.

Some of the improvements in power transformers (1922 to 1932) are improved oil, sliverless copper, paper-insulated conductors, brazed coil connections, better gums and varnishes, inert gas to protect the oil from oxygen both in operation and during shipment, and surge-proof design. Impulse testing to meet basic insulation levels has been of particular significance. The impulse strength of transformers has doubled in the last 24 years, while the protection ratio of lightning arresters has decreased by one-half. This means that where the protection afforded by lightning arresters was marginal or questionable in the early '20s, the present protection devices limit the voltage under similar conditions to approximately one-half of the surge strength of the transformer winding. This gives a large margin of protection ability and therefore a much greater degree of assurance of protecting the transformer under all types of service conditions. Modern protection devices give good protection to many of the older transformers. The methods of applying protection devices are now much better understood than they were 20 years ago.

Transformer Improvements

Since 1932 we have adopted such general improvements as better tank seals, stronger mechanical parts, better bracing of conductors, better insulation through vacuum filling, steep-wave front design and testing, loading by copper temperature and the air-cooled transformer in classes up to 15 kv. The use of a relay that closely follows the thermal characteristics of the transformer, allowing maximum loading within safe limits, permits greater utilization of transformer capacity.

Auxiliary cooling equipment has been used extensively in the last decade to increase transformer capacity. This allows a normal economic selection of transformers for ordinary operating conditions but provides reserve capacity. Loading by copper temperature utilizes the equipment to its fullest with minimum risk of danger.

One of the outstanding contributions to more reliable operation of distribution transformers has been the improved impulse characteristics. In 1,900,000 transformer years of service the field failure rate of the protective devices used with transformers of modern design has been 6/1000 of one percent per year. In the last decade distribution transformer failures of all types including windings, protective devices, etc., dropped from 8/10 of one percent failures per year to 1/10 of one percent on one group of transformers.

With the conventional methods of protection used approximately a decade ago, outages could be expected on 10 to 20 percent of transformers each year. With the more modern methods of protection that have been devised, this has been reduced to a fraction of 1 percent. One company after a complete review of their transformer troubles found that 70 percent of their interruptions in 1942 were caused by lightning. With conventional protection devices they had trouble on 15.7 percent of their conventional transformers through fuse operations while with the more complete type of protection, without fuses, the failure rate was but 0.4 percent.

With the greater reliability of modern distribution transformers they can be loaded higher than was thought possible a decade ago. Within the limits of regulation, system costs can be lowered quite materially through working the distribution transformers up to their thermal limit.

Where Concentrate Effort?

The natural question is, "Where can we get the greatest return for a given amount of effort?"

Approximately 58 percent of the cost of an electric light and power system is in distribution. I believe it is possible to minimize the equipment in the distribution system to lower costs when making changes or extensions and still retain the quality of service demanded.

In thinking of how to lower distribution costs a number of schemes are available. The central distribution substation can be used or small distribution substations can be distributed at many points on the system. In feeding industrial loads, loop feeders with elaborate tap point equipment can be used or radial feeders with multiple feed or a number of combinations with their varying degree of cost can be used. The selection will depend on the importance of the customer process and the size of load. Again in the residential and commercial areas consideration can be given to radial systems, low-voltage network systems or primary network systems, depending on the load

density and the type of service to be furnished.

Comparative Substation Designs

A typical distribution substation, which will be called substation "A", is provided with multiple high-tension buses and main and auxiliary breakers on the secondary bus and a transfer bus for cutting regulators in and out of service (Fig.1). For the purpose of discussion, the equipment cost of this station will be taken as 100 percent or $22 per kva. of firm demand at the substation. This station does all that a distribution substation should do, but its cost is high due to the use of single pole switching on the 4-kv. primary feeders and the individual voltage regulation on any phase. Use of 4-kv. auxiliary and transfer buses and the many disconnecting switches, to minimize the time of a service outage should a failure occur in a substation, and to facilitate maintenance of equipment, is expensive. With modern equipment this station is more elaborate than necessary.

Introduction of standard metal-clad switchgear with removable multiple-operated, three-pole breakers and the use of triplex regulators result in considerable saving. Substation "A" has been modified to permit the use of this modern equipment which becomes substation "B" (Fig. 2). Three-phase feeder operation instead of single-phase operation results in a sub-station cost of 63 percent or $14 per kva. Installation cost, although lower than that for the first substation, will be relatively high when building and wiring costs are included.

Further cost reductions may be made by changing the fundamental substation diagram. Substation "C" (Fig. 3) is designed on a 4-kv. unit feeder basis. There is no 4-kv. bus in this substation. With this type of distribution, employing relatively large circuits, facilities must be provided outside the substation on the 4-kv. feeders for switching the load of any feeder to two or more adjacent feeders so as to restore service quickly following a feeder failure. The outstandng advantages are simplicity, unit design with accompanying flexibility for load change decrease in possible 4-kv. short-circuit current and the accompanying system voltage disturbance, lower losses, and its lower cost. The equipment for this substation will cost about 54 percent of that of "A" or $12 per kva.

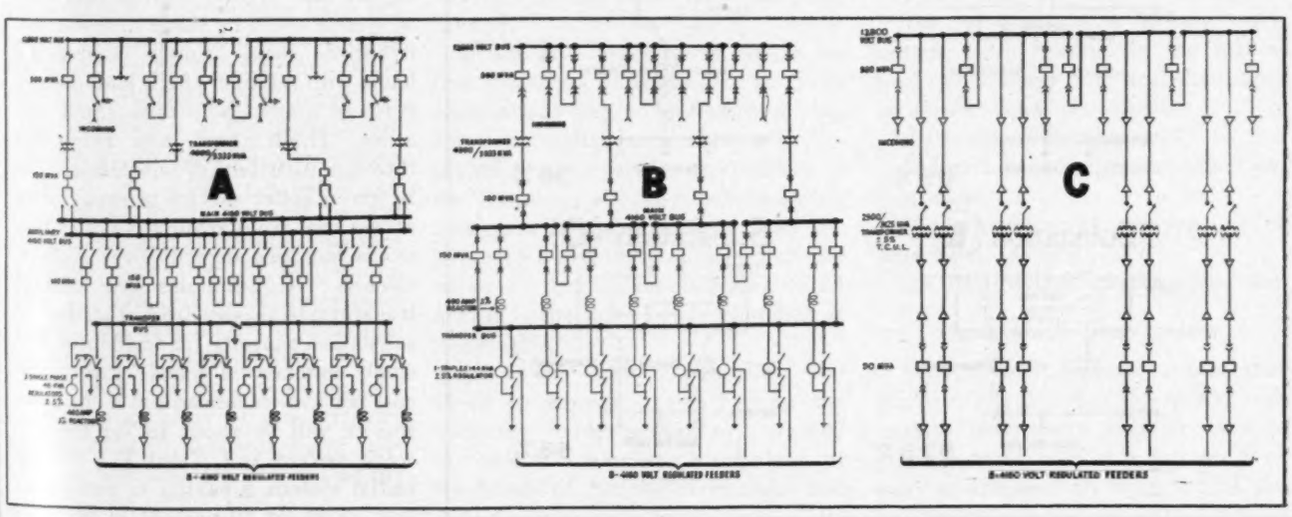
Flexible Design

The transformers and voltage-regulating equipment of substation "C" cannot be as conveniently de-energized for maintenance as in the case of substation "A" without the dropping of load, because load must be switched outside of the substation from one feeder to others. Where external feeder switching equipment is not available, this substation can be modified to include a transfer bus, thereby permitting all switching for maintenance of station equipment to be done in the station. Station equipment cost will have been increased approximately $2 per kva., with a slight increase in building and installation costs.

Thus, where new designs and the greater reliability of equipment and lines are taken into account, combined installation and equipment costs result in a substation costing less than 50 percent of that of the more elaborate substations designed and built on the basis of former service records and experience with the older types of equipment.

Why, then can substation "C" be considered when substation "A" was once deemed necessary? Reviewing the data given on reliability of apparatus and lines, the 4-kv. cables have only about one-third the probability of failure now that prevailed in the '20s and transformers have been improved even more. This alone justifies a change from single-phase to three-phase operation as the outages per customer caused by cables and transformers should be about the same or even less. The complicated bus arrangement of yesteryear was provided so that feeders could be switched in case of failure of equipment in the substation itself. The probability of failure of equipment in the substation has been minimized because of the complete factory testing. Metal-clad switchgear with complete enclosure of all live parts, air-insulated transformers with tap changing under load and air circuit breakers throughout allow placing all the equipment together in one building. The necessity of single-phase regulation in all cases is questionable.

These same arguments hold for open lines as for cables. Overhead lines are now being built with self-clearing characteristics, but if faults still persist, the vast majority are cleared by de energizing the feeder



FIGS. 1, 2 and 3 Typical distribution substations A, B and C

and service is automatically restored in a few seconds.

Another opportunity for economy is in the equipment for distribution systems serving small and medium-size industrial customers. Substation "J", costing $22 per kva. (Fig. 4) provides excellent loop service to the customer. It probably gives better service continuity than can be economically justified for many industrial customers.

Once in 5 Years

Probabilities are that a fault will occur about once every five years on one of these industrial loops. If so, substation "K", costing about $15 per kva., can be used to provide adequate service to most customers.

The few customers requiring best possible service continuity can be supplied most economically through substation "L". This substation gives somewhat better service than substation "J" at an equipment cost of approximately 92.5 percent or about $20 per kva. By using substation "K" for 90 percent of the industrial customers and substation "L" for 10 percent of them, instead of using substation "J" throughout, an aggregate saving in industrial substation equipment cost of 29 percent can be made.

A further saving in investment can be made by using two radial feeders to supply a group of industrial customers, as shown on the right of Fig. 4. Length of cable required will be anywhere from equal to about 50 percent more than that required when the loop supply, depending upon the geographical location of the customer served. Substations "M," "N," and "O" are comparative to those discussed for the loop feeders. When using the radial feeder and substation "N" for 90 percent of the customers and substation "O" for 10 percent of the customers, a saving of 62 percent in substation equipment cost is made when compared with using the 13.8-kv. loop feeder and substation "J". Even if substations "K" and "L" are used, as recommended with the loop feeder, the saving in substation equipment cost is 47 percent if the radial feeder and substations "N" and "O" are used. The radial feeder and substation "N" make it economical to supply in this manner many small industrials now supplied through the large distribution substations along with the residential and small commercial customers. This will release distribution-substation capacity for residential load growth.

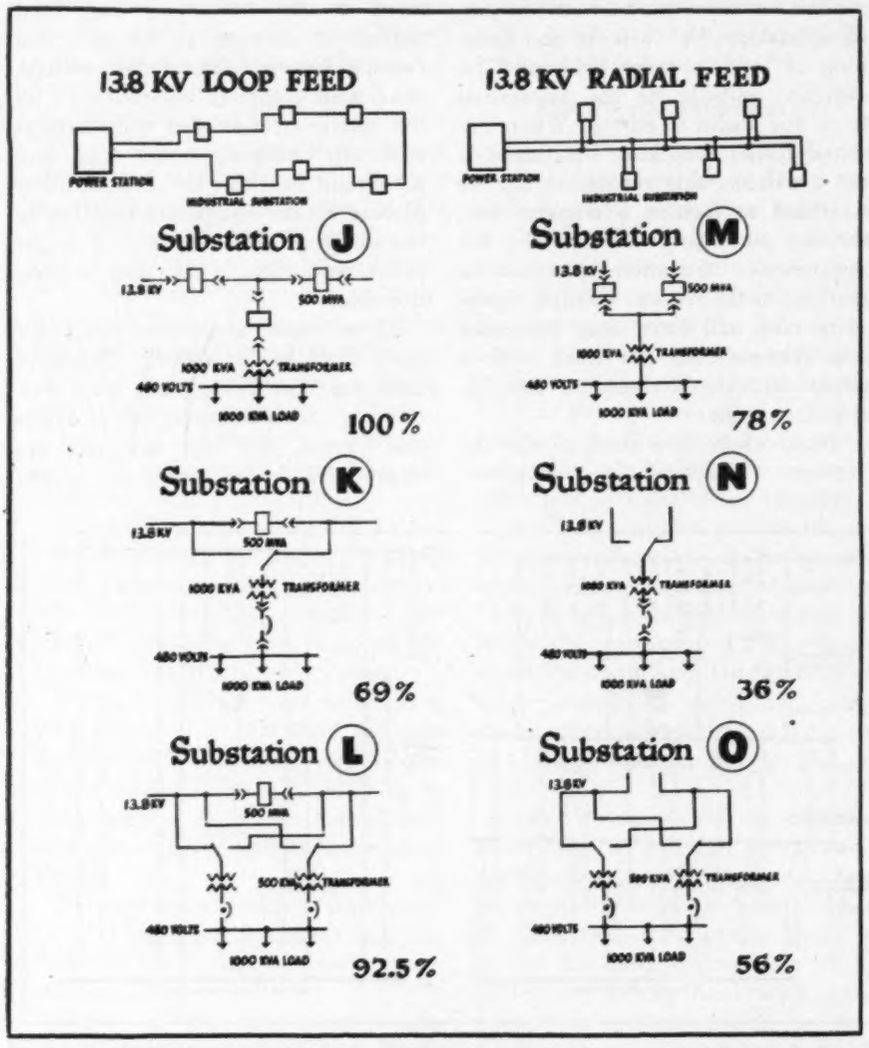


FIG. 4 Industrial power supply by loop and radial feed

Network Distribution

The primary-network system is flexible because in it a much larger number of relatively small substations are located at or near what would be the load centers of the 4-kv. feeders in a system using large substations tied together on their 4-kv. sides to provide service at least comparable to that rendered by the radial system. The equipment cost of one of these substations using outdoor equipment is about $11 per kva. compared with $12 for large substation "C" (Fig. 3). The small primary-network substations can be installed when needed and can be moved from one location to another as changing load conditions dictate. Thus, system investments can be made to follow load requirements closely. The primary network should be seriously considered for serving residential and small commercial customers whenever a system extension or major change becomes necessary.

Secondary-network systems in areas of high load density are now accepted and greater use of this type of system could be made to lower distribution costs. Small commercial loads with relatively high load density exist in many spots throughout city areas. These areas, now being fed through distribution substations can be given better service in many cases at less cost from small secondary networks supplied directly over 13.8-kv. circuits. It eliminates one voltage transformation and frees distribution substation capacity for residential and small commercial loads. Equipment cost per kva. of demand at a customer service will be about $8 for the network system and about $11 for the radial system, a saving in equipment cost of about 20 percent in favor of the secondary network.

Leadership in Post-War Community Development

Transmission-type utility initiates and develops plans for reemployment in small cities and towns in cooperation with local agencies. Agricultural and industrial production, marketing methods and municipal improvements included in programs

*S. P. VECKER, Vice-President, Carolina Power and Light Co.**

THE TASK of private enterprise is to channel the thinking of individual citizens along lanes of thought that a conservative Federal fiscal policy undoubtedly will be for the best interests of the country as a whole. Eventually, the public will arrive at the conclusion that our economic salvation is dependent upon a flourishing competitive free enterprise system. With the arrival at such a conclusion we come face to face with the necessity of answering the question "What have you done and what are you doing to provide the necessary stimulus?" If tomorrow is to be peaceful and prosperous, then we must make tomorrow's plans today.

Plan Tomorrow Today

Realizing that our hopes for the future are dependent upon plans for the present, a program was launched by my company more than a year ago which we have designated as "A Plan for Community Betterment."

My company is of the transmission line type, embracing 288 communities in North and South Carolina. Of that number there are only two of 50,000 population or more, and four of slightly more than 10,000 population. The remaining 282 towns and communities have an average population of approximately 1,700. In the development of a program to improve the economic status of our territory and consequently provide more jobs after the war, the small town was the pivotal point of the plan.

A distinct Community Betterment Department was created and a person of long experience with the company and intimately familiar with the territory served was assigned the responsibility of developing the plan of community betterment and coordinating its various phases.

Although the idea of community betterment is being promoted under the sponsorship of my company it was necessary to organize in each community a central committee composed of leading citizens who were willing to assume the responsibility for effectuating the work.

The majority of communities involved have no chambers of commerce or trade associations, and in some cases are too small to support an active civic club. Contacts, therefore, were made through the company manager or representative in the community.

In the few larger towns where active chambers of commerce or trade associations were to be found the plan for community betterment was presented to the executive committee of the chamber with the understanding that upon acceptance of the plan, the company's identity would be lost and whatever benefits might result would accrue to the favor of the chamber or association.

In towns and communities too small to support trade bodies, the company representative worked through a committee comprised of the heads of various civic clubs and organizations or other interested individuals. In the majority of cases this group was referred to as "The Committee for Community Betterment." Inasmuch as all civic organizations were represented on the committee, the program became the property or project of no particular group and consequently was given the support of all.

After the formation of the Committee for Community Betterment, the company manager sat in its meetings as a member and acted as a spark plug, so to speak, by supplying the committee with materials and procedures from the company's general office. At the same time the company representative assisted the committee in gathering information on which local plans depended. Information thus compiled enabled each committee to determine local needs more intelligently and consequently provide a logical basis for future planning.

The research efforts of local committees have resulted in the formation of a general program which may be divided into four phases:

Agricultural development

Industrial readjustment and development

Modernization and expansion of municipal facilities, and

An improved marketing program.

Agricultural Development

My company, keeping in mind that the primary object of the entire community betterment program was to provide more jobs at a fair scale of pay, established an agricultural development department. Its function is further to implement the general

* Abstract of paper to 1944 EEI annual meeting

program and to facilitate specific rural planning.

Aided by state agricultural colleges, county farm agents, and local rural committees, additional farm research was undertaken. Here are some of our findings:

Not more than two percent of the canned and packed foods consumed in our area were processed locally.

Total output of creamery butter would give each person in the area not more than half a pound per year.

Annual volume of fruits and vegetables canned in the area would equal no more than a day's supply.

The year's local production of sausage and prepared meats in the area would be consumed in less than a week.

We, in the Carolinas, estimate that at least 100 million dollars can be kept at home annually by processing foods which we are as well suited to produce as any area in the nation. In fact, the greatest drain on our income is an export of cash for imported food, a large part of which is grown in the area but processed elsewhere after being sold at wholesale rates, leaving the grower with a minimum of profit. If this program results in nothing more than the location within the area of adequate food processing facilities, the problem of unemployment will be substantially solved. We further found that the possibilities in the dairying and meat packing fields are almost as great.

Plans for Municipal Facilities

The phase of community betterment which offers greater immediate postwar possibilities is the modernization and expansion of municipal facilities. Existing facilities were in most cases taxed to capacity prior to the war. Many were outmoded and in need of repair or replacement. Wartime restrictions have prevented the necessary corrective measures. Wartime conditions have created circumstances which have served to emphasize these weaknesses.

Since the majority of towns served do not employ a city engineer, no accurate appraisal of present-day conditions and postwar needs was available to the municipal authorities until the Committee for Community Betterment made these local studies. Inasmuch as such studies involve matters which may have political implications, it was necessary in the majority of cases for the committee to submit their findings to the municipal council with the understanding that the committee would claim no credit for municipal improvements provided the council elected to proceed with the program. The only way in which the committee would be further identified was through its offer to give active support to those recommendations made to the public for the improvement of municipal facilities.

Appraisal of Needs

In order to be equipped with specific information regarding every facility of the town or community a set of forms was prepared by my company to be used in making this appraisal. The company's name did not appear on these forms, nor was there any means of identifying the company with this survey. These forms comprise a complete questionnaire in the treatment of each subject such as water works, sewerage systems, street lighting, public buildings, parks and playgrounds, air fields, incinerators, street paving, fire protection and other miscellaneous municipal facilities. Basic information such as population at present and estimated population five and ten years hence—electric, water, sewerage, gas and telephone users—capacity of water pumps, stand pipes, and reservoirs—in fact, space was provided for every item needed to make a thorough study. This provided each community with the type of information concerning every public facility in its area so that intelligent planning can be effected with respect to immediate and long range post-war municipal needs.

The fourth, last, and most important phase of the community betterment program is that of finding markets for products of agriculture and industry. No post-war program for community betterment can be complete until provision is made for accelerated sales, distribution and service activities.

Just as our nation is dependent for prosperity upon active participation in world trade, so is local community betterment dependent for success upon its ability to establish acceptance for the increased production which should result from accelerated activity in agriculture and industry.

In the establishment of markets for farm products, the assistance of state, county, and local farm agencies must be enlisted. Not only can they be of help in the matter of providing outlets, but the research efforts of the departments they represent are invaluable in projecting requirements of various agricultural products.

The establishment of profitable markets for products of new industries is a difficult problem and consequently deserves not only the full support of community leaders but the coordinated efforts of various communities within the area. It must be remembered that new and relatively small processing plants engaged in the manufacture of products under new trade names will find it extremely difficult to market such products in competition with national brands.

National Markets Also

It is to be hoped that the marketing program will not be limited to the supplying of local demands. The creation of a national demand by representation on national markets will further stimulate every phase of the local economy. This program, however, does not anticipate the exclusion of products manufactured elsewhere—we realize fully that our section of the country is dependent upon various other sections for products which are in heavy demand and which cannot be manufactured profitably within the area.

It has been and still is our belief that a program of community betterment soundly conceived and persistently pursued is the only way in which jobs may be provided without further burden to tax-payers and without undue risk on the part of agriculture and industry. In no instance has this program reflected any cause whatsoever for higher taxes. Nowhere is allowance made for the return of present job holders to relief rolls. It is purely an American approach.

With agriculture, business, commerce, and industry providing higher levels of employment through a planned program, the needs of humanity will be met and there should be no necessity for the government to assume the roll of employer at the expense of the taxpayer.

I have faith that the competitive free enterprise system can provide that employment. However strong that faith may be, I am equally certain it would result in a fruitless end unless supported by a program of work.

The Heat Pump as a Load Builder

Reverse refrigeration holds out great promise for home and other space heating—Can readily be made competitive with fuels and offers prospect of average annual domestic consumption of over 14,000 kw.-hr. —Need for fast work in development

*PHILIP SPORN, Vice-President and Chief Engineer, American Gas & Electric Service Corp.**

THERE ARE five principal services that electricity performs in the modern home today—lighting, refrigerating, cooking, water heating and operation of miscellaneous appliances or devices. The sixth, and most important function—more important, in fact, than all other five functions put together—namely, heating, is today still performed non-electrically. It can in most cases be performed electrically by the heat pump. I hope to show in this paper why this is so, and how it can be brought about. My aim, primarily, is to stimulate interest on the part of all those responsible for, and concerned with, the development of the residential electric loads on the systems of electric utilities of this country, to a sufficiently high point where they will begin to do something about it. Specifically, I should like to see them do at least a portion of their share of the job that needs to be done if the all-electric home which is so glibly being talked about is to become a reality. For if this job is not done, the all-electric home may continue to be a very much sought-after but elusive will o' the wisp. It may, in fact, become less electric than it is today.

Let us take a look at the market that is available from an energy standpoint in the homes of the United States if we undertake the job of supplying heating. Available records indicate the annual production and consumption of fuels used for heating of homes in the United States in the year 1940. They shows a total consumption of fuel for the year for heating of 5,038 trillion B.t.u. It is estimated that of this amount the annual useful heat is only 47 percent of the fuel burned and the balance, 53 percent, is escaping up the residential chimneys. Disregarding cost of attendance and repairs, and figuring only fuel cost, one arrives at a conservative figure of $1,682,000,000 for the year. This is almost twice the total electric residential bill of the United States for that year. Why should we not try to develop electrical residential heating?

There is another way of looking at this problem. The annual useful heat (on the 1940 basis) of 2,382 trillion B.t.u. when converted to equivalent electrical units represents an annual energy consumption of 697 billion kw.-hr. The heat pump offers a way of eliminating the handicap that electric energy is under when it attempts to enter the space heating field on a straight energy conversion basis, and by furnishing heat equivalent to from 3 to 5 kw-hr. for every kilowatt-hour of electric energy input (This is sometimes expressed by saying the heat pump has a coefficient of performance of from 3 to 5.) makes possible, and wholly practical, the supplying of electrical heating service to residential and commercial establishments. If it is assumed that this fundamental advantage of the heat pump, through its so-called coefficient of performance, is maintained at 4½, then the 697 billion kw.-hr. of electric energy equivalent to the annual heat supplied by other fuels now utilized in the United States, could be supplied by approximately 155 billion kw.-hr. of electric energy, and this is roughly 5.25 times the total estimated electric energy consumption of all residential consumers in the United States in 1944.

What kind of operating costs will

Table I. Comparison of Equivalent Cost of Heat by Heat Pump and by Fuels

COST OF ELECTRICAL ENERGY PER KW-HR., CENTS	COST OF FUEL ON EQUIVALENT OUTPUT BASIS				
	COAL, PER TON		GAS, PER 1,000 CU. FT.		OIL, PER GAL.
	12,000 Btu PER LB.	14,000 Btu PER LB.	550 Btu PER CU. FT.	1000 Btu PER CU. FT.	125,000 Btu PER GAL.
1	$10.20	$11.90	$0.234	$0.424	$0.052
1½	15.30	17.85	0.351	0.636	0.078
2	20.40	23.80	0.468	0.848	0.104

Assumptions: Coefficient of performance of heat pump, 4.5; efficiency of conventional heating systems, 65 percent.

* Abstract of paper to 1944 E.E.I. annual meeting.

Table II. Energy Consumption in the Electric Home of Tomorrow—kw.-hr. per Year

CLASS OF ELECTRICAL APPLIANCE	WITHOUT ELECTRIC HEAT AND AIR CONDITIONING	ELECTRICALLY HEATED AND AIR CONDITIONED BY HEAT PUMP
Lighting, Misc. Appliances	346	346
Refrigerator	312	312
Radios	80	80
Flatirons	64	64
Washing Machine	24	24
Vacuum Cleaners	20	20
Toasters	15	15
Electric Clocks	14	14
Roaster	225	225
Ironing Machine	100	100
Percolators	72	72
Space Heaters	45	45
Water Heating	2,625	1,308
Range	975	975
House Heating	0	8,900
House Cooling	0	2,000
TOTAL	4,917 kwhr	14,500 kwhr

heat pumps give when used for heating? The following is quoted from a more detailed discussion of the heat pump recently published:*

"A comparison of the operating cost of a heat pump with a conventional system is rather difficult because operating cost in a conventional system is quite variable, depending upon the type of fuel used, type of equipment employed, and the care with which it is operated. Nevertheless, it is interesting to show even roughly a comparison of the two systems. For this purpose, Table I has been compiled to show the cost of three different classes of fuel when compared with the output from a heat pump at three different costs of electrical energy.

Competitive with Fuels

"Under conditions assumed, that is, with a coefficient of performance for the heat pump of 4.5 and an efficiency for the conventional heating system of 65 percent, the heat pump using electric energy at one cent per kilowatt-hour is fully competitive from an energy output standpoint with 12,000 B.t.u. coal at $10.20 and with 550 B.t.u. gas at 35.1¢. But it is important to remember that the cost or trouble of attendance, rather than the cost of fuel, has an important bearing on the choice or rejection of a coal-fired heating system in many buildings.

"While this analysis admittedly considers only some of the phases of the competitive problem, it does clearly show that with a reasonable coefficient of performance, the heat pump with its special advantages can be brought to a competitive level."

Have heat pumps been built and are there many of them operating? Answer: Yes, a number have been built and are operating; in the United States there are perhaps 30 or 40 in operation. There are a number of others in Switzerland and in South America. But the number is altogether too insignificant. On the American Gas and Electric Co. system there are seven installations and all are furnishing heating in the wintertime and cooling in the summertime, giving year round air conditioning. They are all doing, on the whole, a first rate job. Two of the latest of this group were installed, and are functioning, in office buildings of the Ohio Power Co.

If you plot the typical daily load curve for an average winter day of a residential consumer using all appliances, lights and the heat pump, you would get a curve resembling very much that shown on page 101. Here are shown in outline the total load curve of a typical modern customer and in the hatched area the load curve of all of the customer's load except the heat pump. A short dotted line on this figure shows the level of the maximum demand of the heat pump alone. While this curve shows a number of sharp peaks when the heat pump demand is superimposed on the peaks of the other load, this is characteristic only of an individual customer. The origin of these peaks is traceable to other loads than the heat pump; loads which we now serve, whose peaks we know by experience are smoothed out when combined in larger groups. Because of the inherently high load factor characteristic of the heat pump load there should result an improvement in group load factor as a result of serving the heat pump. It is interesting to note that the individual peak demand on the distribution system capacity imposed on it by a heat pump is less than that imposed by a present day otherwise fully-electrified (that is, non-fully-electrified) home. While it is true that to serve a large number of heat pumps will require a greater system investment than to serve an equal number of customers having all kinds of equipment except the heat pump, this is due solely to the lower coincidence factor, along with the poorer load factor, of the latter type of customer. The expansion of the heat pump load will doubtless present some distribution problems. But these should be no more formidable than those that have been presented to the industry heretofore by several of the present heavy demand devices.

Energy Consumption

The monthly kilowatt-hours consumed in a typical year by a heat pump in an average well built six room house in the vicinity of Pittsburgh have been calculated, based on the assumption that the house has a volume of 12,000 cubic feet, that it is well insulated and uses double glazed windows. The heat loss of such a house on a —10 deg. F. day would be approximately 54,000 B.t.u. per hour. This home could be heated with a heat pump having an average input of 3.5 kw. and a probable maximum input of 4.2 kw., provided the average coefficient of performance was 4.5, and an off-peak storage tank of approximately 1,000 gallons is employed. This would require a total yearly kilowatt-hour consumption for both heating and cooling of 10,900 kw.-hrs., of which 8,900 are heating and 2,000 are cooling. This then would make possible a consumption in the electric home of tomorrow as in Table II.

If what has been brought out up to this point has been sufficiently impressive and convincing to lead you to think that electric heating of homes by the heat pump can be made

* *Heating and Ventilating*, January, 1944.

practical, and that it is, as a matter of fact, the only way that the all-electric home can be made a reality, then at this point there will arise in your mind, or I hope there will arise the question "How can we bring it about and what should be done? What should we as individual engineers, sales executives, operating managers or utility executives do about it?"

I have given this matter a great deal of thought and I have the following suggestions:

1. Assign some well trained and otherwise well qualified people in your organization to go into the problem, to study it and to follow it. Do this at once. Let them—

2. Invent, or promote, stimulate or help the invention and development of new and better compressors, heat transfer devices, and thus better heat pumps. Most of this work should be done by the manufacturers. Therefore,

3. Establish intimate contacts with every reputable air conditioning manufacturer and see whether you cannot interest him in starting a program of development on the heat pump.

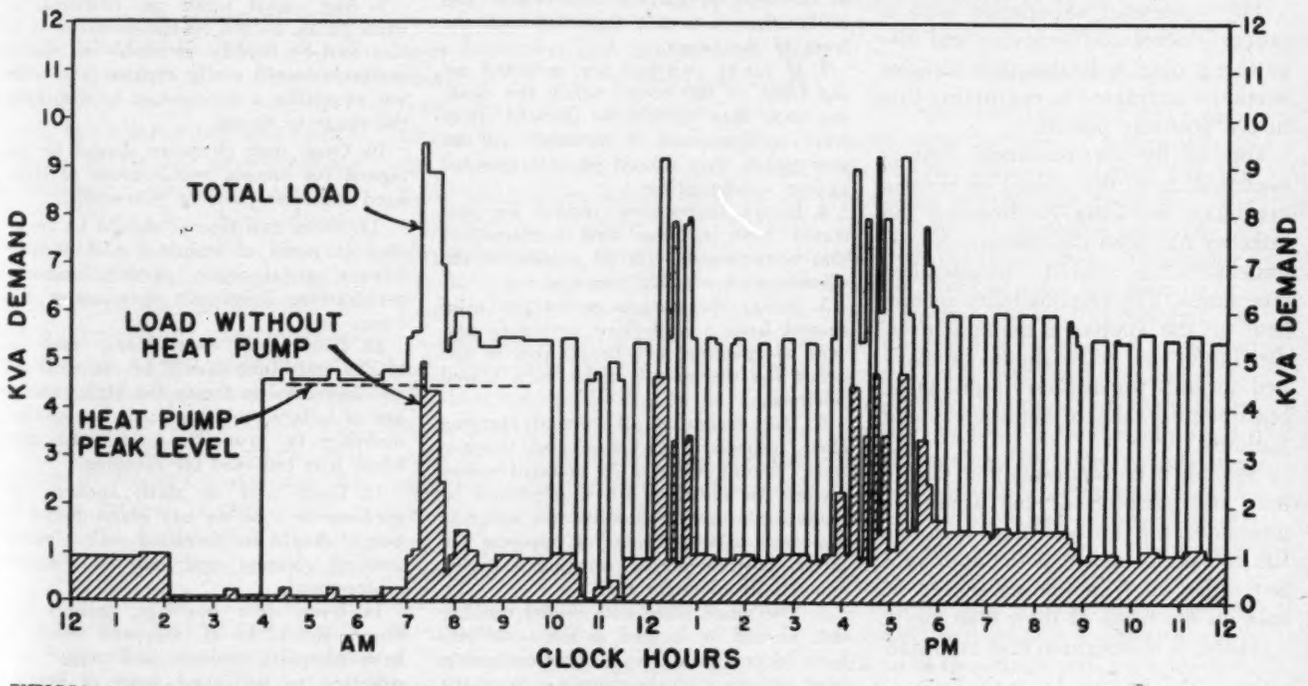
4. Of the group indicated in (3) above, make a special effort to establish contacts with those who are electrical manufacturers. Then make contact with the other electrical manufacturers, big, medium-sized and small, who may not at present be interested in air conditioning. If the bigger manufacturers cannot, or are not disposed to, pick up the idea, perhaps the smaller ones can, and will. The best news I have heard in connection with the heat pump since we first started working on the problem in our company more than a decade ago occurred within the last thirty days, when a mid-western manufacturer of coal stokers informed me that he expected to have 50 heat pump installations in service in homes by the end of this year.

In Utility Buildings

5. Many of you are, without a doubt, preparing plans for post-war construction of office buildings, service buildings, operators' cottages and structures of that kind. Make it a point to see that a heat pump installation is carefully considered in each case and all the factors bearing upon the choice are given consideration and see if a heat pump installation cannot be justified. In that connection do not lose sight of the importance to your own organization to obtain the know-how, the feel and understanding of the many advantages, and also of the problems and difficulties, and of the means for solving them, presented by heat pump heating and cooling.

6. It may be necessary and desirable to establish contacts and set up some cooperative program with other industries. There are such people as progressive and forward-looking builders of homes and a number of these must be found who could be interested in developing the all-electric home. We badly need the benefit of experience that can come only from building heat pump heated and cooled homes to be occupied by typical American families. We need the experience gained from having hundreds of such homes lived in next winter.

7. Above all, let us keep in mind that there is no time to lose. The gas industry, for example, is not dedicating itself nor its talents and efforts to developing the all-electric home. On the contrary, it is all set to make every home it can reach less electrical than it is today. We should have no quarrel with them for that attitude. But those in the electric industry who have no gas responsibilities are particularly concerned with expanding electric use. It is this group, therefore, that must make up in enthusiasm and intensity of effort for the failure of the electric industry to do more than it has done to date with the heat pump idea. They have to make up for a lot of time lost in the last decade in the course of which the competition to electric heating of homes had made large forward strides. But it may not be too late, if a start is made now.



TYPICAL daily load curve for a residential customer on an average winter day. Cross-hatched areas show load of present-day appliances and lighting. Superimposed white areas show the load of the heat pump

Better Customer Service at Less Cost

War-time experience points to ways for improving post-war operations—Suggestions for better designed appliances and for definition of where service responsibility lies

R. E. FISHER, Vice-President, Pacific Gas & Electric Co.*

DURING WAR TIME, in compliance with the necessity of conserving manpower and automobile mileage, it has been necessary that utilities re-examine the many transactions involving service to customers and develop ways and means of operating most efficiently, and at the same time maintain a high level of service. The practice today is that of receiving and dispatching requests for service, including appliance adjustment requests, on a basis of executing as much of the work as possible as routine, with provisions for giving immediate attention only to special or emergency requests.

The successful experience with a properly developed receiving and dispatching plan indicates that utilities would be warranted in continuing this in the post-war period.

One of the circumstances that is contributing to the ordeal of electric appliance servicing confronting the industry has been the customer's misunderstanding about meaningless guarantees. The responsibility incumbent on the appliance manufacturer, distributor and seller should be clarified not only for ordinary retail sales, but quantity sales to contractors and builders.

Second, it is important that the intent and purpose of the appliance guarantee not be confused with the life and performance of the appliance but rather that appliances should be sold on the basis of their true merit.

Third, it is desirable that manufacturers review the confusing practice of one year's guarantee of parts required for the maintenance and repair of old appliances, and instead organize this servicing work on a sound basis comparable to that of other leading industries.

Another aspect of appliance servicing that we should challenge is the subject of appliance design and proper engineering standards. This is a challenge that should be heeded by the manufacturers of all types of domestic electric appliances. However, the situation is particularly serious as it applies to electric ranges and water heaters, according to a recent report by service engineers who analyzed the common causes of service problems with 150,000 electric range and water heater customers. I think it is significant to enumerate certain recommendations based on this field study and as below they are submitted for the consideration of electric range manufacturers.

These comments below generally apply to all makes of electric ranges. They are not intended necessarily as criticisms but rather as constructive suggestions for general improvement in design, simplification and proper engineering standards. Time will not permit enumerating similar suggestions regarding other types of appliances. However, it behooves manufacturers to re-examine performance records and embody in all of their appliances the highest degree of proper engineering standards and improvement in design.

Recommendations to Range Manufacturers

1. Uniformity of top opening for surface units to facilitate the installation of various sizes of units.

2. Proper engineering standardization of the type of surface unit switch and its location to permit servicing from the front of the range.

3. If range switches are mounted on the front of the range below the cooking top, they should be located away from spillage, and if mounted on the rear panel, they should be safe guarded against condensation.

4. Range thermostats should be protected from spillage and condensation that is responsible for 90 percent of the trouble with electric contacts.

5. Range thermostats inside the oven should have a protective device to prevent overheating and breakdown in the event the thermostat sticks in a closed position.

6. The design of all current carrying parts, especially switches and thermostats, should have a 50 percent safety factor. In addition, provision should be made for proper insulation and adequate clearance between poles of opposite polarity, positive acting cams, and spring contacts of adequate size.

7. The name plate with model number data should be located in the same uniform place rather than at different points most anywhere on the range; even on the back of it, which is most inaccessible.

8. All ranges should have a screw device at the floor position to level the range instead of requiring shims or blocks under each corner floor rest.

9. Any signal lights on switches, or oven lights, should be standardized as to size and be readily accessible so that a customer could easily replace one without requiring a serviceman to dismantle the range to do so.

10. Oven unit elements should be designed for simple replacement of damaged insulator parts or wire coils.

11. Oven unit frames should be enameled or made of stainless steel or nonferrous metal since present common construction frequently deteriorates and burns out.

12. Oven unit connections, such as blades and clips, should be standardized and improved to lessen the high percentage of failure resulting from housewives' inability to properly install the unit when it is removed for cleaning.

13. Deep well or thrift cookers, regardless of style on any given model of range, should be designed with a standardized element and coil to simplify replacement.

14. Oven door bearings, springs and hinges should be of improved design to have adequate strength and rugged construction to withstand years of service without reoccurring failure.

*Abstract of paper to 1944 EEI annual meeting

Getting Ready for Post-War Business

Report of commercial planning committee tells of work done and in hand to aid utilities in setting up programs of load building when the war ends — Effects of developments in lighting and other power applications related to different load classes

*MERRILL E. SKINNER, Vice-President, Buffalo, Niagara & Eastern Power Corp.**

IN DISCUSSIONS of post-war planning, we frequently encounter the statement that a favorable business environment is being assumed. Can we take it for granted that there will be a favorable business environment for the electric utility companies? Sooner or later the American people must decide whether the electric utility business is to be owned and operated by government instrumentalities or whether the present mixed situation of part under government ownership and operation and part under ownership by individual investors and operation by business management is to be maintained. The question before the American public is simply this, "What degree of public ownership can there be, before the political party in power (whichever that may be) attains sufficient control of votes to perpetuate its control and thus establish national or state socialism?" When the public decides this question it should be with open eyes and a full comprehension of the significance of its decision. We who are employed in this great industry can sit on the side lines as spectators to this struggle of political ideologies, or we can actively participate in the debates which will eventually determine the outcome. As long as the present mixed situation exists and until the issues are finally determined by the American public, it seems to me there is a duty upon us in behalf of the investors and owners of the electric utility industry to urge that both types of ownership operate under the same rules. If present discrimination continues, it may eventually accomplish the socialization of the industry without public realization of what is happening.

Post-War Load and Capacity Ratios

The starting point in any commercial planning should be a consideration of the probable relation between load and capacity which might be expected in post-war years. Such a study will determine whether load building activities should be approached on the basis of an overloaded or underloaded supply. Somehow an impression has been created in the minds of many manufacturers and others that the cessation of war production would leave the utility companies with a tremendous amount of unsold capacity, and that more or less desperate sales techniques would have to be employed to quickly load up this surplus capacity. An inventory of the situation among a number of representative utility companies failed to confirm any such conclusion and the committee felt that a study of the situation nationally should be undertaken and the results publicized in order to give the trade press and the electrical manufacturers a clear picture of the probable post-war situation. Through the excellent statistical information available at EEI headquarters, it was possible to collect these data quickly.

"In regard to the generating capacity of the investor owned companies, it may be concluded that, large as the probable excess may appear in contrast with the heavy loads of 1943, indications point towards a balance between capacity and use comparable to that existing in the average of the years 1936-7-8 which are becoming more and more clear as representing a reasonable approximation of 'normal' of the American business structure. . . . For the publicly owned plants, however, the picture is different. . . . it seems improbable that developments utilizing large quantities of aluminum or other products consuming great amounts of power in their manufacture can be affected rapidly enough to avoid a few years of over-capacity in some localities."

National Cooperative Programs

The electrical appliance and equipment manufacturer is interested in the overall national market for his products, whereas the individual utility company is interested primarily in its local operating area. This difference in point of view has been recognized in the past, but the members of the Commercial Planning Committee feel generally that the individual utilities, acting through their trade associations, should enter national promotional activities in fuller partnership with the manufacturers and should support, to a limited extent, at least, the national promotion of which they are locally the beneficiaries. The matter is now under active study and it is hoped that whatever proposals result from this study will have the active support of the member companies of the EEI.

* Abstract of paper to 1944 EEI annual meeting

Central station power will be called upon in an increasing number of cases to meet the threat of isolated plant competition. The quality of service and the rates to be charged for it must be competitive but, even more important, utilities must have trained men intimately familiar with the characteristics of this equipment if they expect to hold this business against this post-war competition. This subject has been under continuous study by the Industrial Power and Heating Committee of the Institute for many years and they have issued periodic reports. At the suggestion of the Commercial Planning Committee, they are bringing their studies up to date and summarizing the present situation in a report which should be of inestimable value to the member companies.

Merchandising Policy and Practices

The general adherence of utilities during the immediate prewar era to sound and recognized practices in the conduct of their merchandising activities has removed most of the acrimony which, at times, attended trade discussions of this matter. A much closer and more cordial relationship now exists than ever before and it is important for the utility industry that this favorable situation continue. In studying this subject, our Committee has recommended to appropriate committees of the Institute a review with interested trade groups of a statement of merchandising practices which could be considered acceptable by all concerned; a review of time payment financing; and the institution of a comprehensive survey of probable post-war attitude toward utility merchandising.

Review of Business Practices

Can't we use this particular time for a soul-searching review of our business practices, trying to view them as our customers see them in an attempt to make it as easy, as convenient, and as pleasant as possible for people to do business with us? Curt, abrupt, or hard-boiled language has no place in the utility lexicon. When you go home, get out some of your frequently used forms, the statements of your rules and regulations, or of your rate schedules and read them over as if you were the buyer rather than the seller. I can almost guarantee that you will be shocked to realize how many things the customer must do in order to patronize your service. This is a matter of individual company review but we can all benefit by an interchange of information and be stimulated by the progress of others in accomplishing improvements.

National Organizations

Another factor which makes this subject of importance is the steady growth of national organizations doing business in many communities throughout the country. They have a unique opportunity to compare the business practices of different utilities and I know from experience that they are mystified and confused by the wide variety of the conditions which confront them in purchasing power for their different operations.

War conditions have decimated the commercial organizations of most utility companies and to rebuild them at the proper time will require the most comprehensive training program we have ever faced. One of the first recommendations of our Committee was the appointment of a special committee to consider the subject of Sales Training. After careful study, they have recommended a training program for sales employees divided into four basic subdivisions as follows—

1) An indoctrination course to acquaint the new employee with basic information about the utility industry and the individual company he is to work for.

2) Basic principles of selling

3) The advantages of electrical service in various fields.

4) Product information

Committee Work in Hand

This brief and sketchy review illustrates the wide range of subjects which are involved in post-war commercial planning and the many committees of the Institute which are now working on one or another phase. Our committee proposes to bring these various matters into focus for the benefit of member companies through a series of reports. The series will consist of the following—

1. *Basic Planning Material* This would be a digest of pertinent statistical and background information particularly selected for its application to the problems of the electric utilities.

2. *Appraisal of Competition* This report will summarize the present status of studies which have been going on for some years on (a) present and future trends in generating equipment using coal, petroleum products and gas, and (b) probable trends in availability, prices and processing of coal, petroleum products and gas.

3. *Available Data Residence Loads* Headquarters staff is undertaking to digest all of the available data and to indicate gaps in the information which should be the subject of further research and study.

4. *Marketing Problems in the Residence Field* The Residential Service Committee is undertaking preparation of a report summarizing the principal factors to be considered in designing post-war load building programs in this field.

5. *Rural Electrification* The Farm Service Committee has assembled a considerable mass of material and will undertake the preparation of a report summarizing the status of rural electrification and the problems in this field.

6. *Post-war Lighting Markets* This report is being undertaken by the Lighting Sales Committee and will include such subjects as the status of lighting markets, probable effects of the transition to fluorescent lighting, possibilities of cold cathode fluorescent, breaking wartime consumer habits of lighting conservation programs for tested and certified lighting equipment, and a discussion of traffic safety lighting.

For Checking Programs

This group of reports will, it is hoped, provide a series of benchmarks against which member companies can check their post-war programs and obtain the benefit of a wide cross-section of opinion on the problems involved.

Our committee has recognized that planning is an individual matter which must have the executive attention of each individual utility company. Most planning work must be done at home. Our objective has been to stimulate such action on the part of member companies and to give thought to improving those phases of commercial activity which have been subject to group action in the past, or might appropriately be so handled in the future.

The War Years, and After

Although costs and taxes are up and rates are down, earnings are less affected than might be expected, an evidence of the strength and resources of the industry for the future

*C. W. KELLOG, President, Edison Electric Institute**

IN THE FOUR years now ending, the nation's annual output of electricity has grown from 137 to 230 billion kilowatt hours, or 68 percent. The load factor (for twelve months ending May 31) has grown from 53.3 to 64.4 percent. The generating capacity has grown from 40.65 to 49.5 million kilowatts, or 22 percent and the maximum demands on our systems from 29.3 to 40.75 million kilowatts, or 39 percent. Reserves today aggregate 8¾ million kilowatts, 21.5 percent in excess of the highest peak load of the current year.

Costs Up. In the four years ending with 1943 the taxes paid by our industry have increased $336,000,000, or 95 percent. The average hourly earnings of our employees have gone from 86 cents to $1.09 (27 percent increase) during the four war years, a cost partly offset by a reduction from 239,000 to 204,000 (or 17 percent) in the number of employees.

Rates Down. While these changes in cost were occurring, the average gross amount received for a kilowatt hour sold went down steadily throughout the war period. In the last prewar year (1939) the average unit price at which electric energy was sold countrywide was 30 percent above the average figure of 1.66 cents per kilowatt hour for 1943.

Taxes. It is very much to be hoped that a practical way may be found, and one which the Congress will adopt, to correct for the continuing discrimination, in the levying of corporate income taxes, between the slow-turnover, high-investment companies and those in which the reverse is the case. The double taxation of dividends, both against the stockholder who receives them and the corporation that earns them, is a long-standing evil, acting as a brake on corporate activity which will be a continuing deterrent to business development in the post-war period. Finally, the complete exemption from Federal taxes enjoyed by our government-owned competitors, represents a tax burden transferred from one relatively small group of citizens to the shoulders of our 32½ million customers throughout the nation.

Return Yields Gradually

War Effect on Earnings. If we take the division of the dollar received from our customers, we find that the proportionate part required for operation, maintenance and depreciation has varied hardly at all during the four war years. (The average annual deviation from the mean was less than one percent.) The proportionate part left after taxes has, of course, decreased, but the actual amount in dollars left for paying a return to the holders of our bonds and stocks has yielded only gradually to the terrific economic forces incident to financing the cost of the war. Gross corporate income, representing the amount available for return on all securities, in 1943 was $46,000,000 (or 5¼ percent) below the corresponding figure in 1939. The balance for common stock was off $27,000,000, or 6⅔ percent in the same period.

Municipal Ownership Elections. During the first three years of the present administration, voters, representing a population average of 4,662,000 per annum, went to the polls and voted 66 percent for municipal ownership. During the three years ending 1943, however, not only was the average population affected by such elections less than one-fifth as large, but the proportion of this smaller number favoring municipal ownership has fallen to less than one-tenth of what it was in the earlier triennium. That is, 1/59 as many people voted for municipal ownership in the last three years as in an equal period eight years earlier.

The Post-War Load

Commercial Work. Looking ahead to peacetime and the availability of equipment, we may expect all-time sales records through the replacement of overworked electrical servants. There should also be great demand arising from the electrification of several hundred thousand new homes that will be constructed each year. In the commercial classification of our business, higher levels of illumination, commercial cooking expansion and air conditioning add to the possibilities of development. In the power field, many new uses of electricity have been developed during the war for saving time and cost in manufacture, notably in electronics and heat applications to industrial processes.

Power Available. The trend of basic economic factors seems to indicate that we are already past the peak and trending downwards with respect to war activities. The relative magnitude of civilian compared to war activities is now much smaller than it was in the last war. The total Industrial Production Index at the end of 1943 was three times the civilian total and was twice as large as the highest civilian level in our nation's history. The record of the last ten years shows a substantially constant ratio between the Industrial Production Index and total electric energy output. Even if, therefore, we visualize obtaining after the war the highest level of civilian industrial production the country has ever enjoyed, the decrease in war production should leave large amounts of electric energy for sale.

* Abstract of presidents' address to E. E. I. 1944 annual meeting

Editorials

S. B. WILLIAMS, *Editor*

The Hundredth Anniversary of Telegraphy

TWO WEEKS AGO the Morse system of telegraphy celebrated its one-hundredth anniversary. It was on May 24, 1844, that Washington and Baltimore were linked by telegraph and thus began the first electric utility service. Fourteen years later the Atlantic was spanned and electricity was on its way toward bringing the peoples of the world close together.

There were many at the time who acclaimed this feat as the forerunner of world peace. Sadly enough on its one-hundredth birthday we find the world engaged in its most bitter of all struggles—its most world wide conflict. There was nothing wrong with telegraphy. It was but a tool and man was not ready to make the concession necessary for sustained peace.

From the telegraph industry came the roots of all the other electric utility services and out of it also came ELECTRICAL WORLD which started seventy years ago as The Telegrapher. In that time the electrical utility services of telegraphy, telephony, radio and light and power have helped to make this country great. Nowhere else are they used as much—nowhere else is the service as good and nowhere else is the scale of living higher. Elsewhere much of these services is government-owned and operated, while here except for small percentage it is privately owned and operated. Can there be some connection?

REA Investigation Proves Nothing

AFTER SIX MONTHS of hearing, voluminous testimony and the expenditure of $7,500, the Senate agriculture sub-committee has brought its investigation of REA to an end without proving anything. It will recommend an independent agency basis for REA and apparently that is all.

The investigation has dragged a lot of people through the mud and has left them and REA suspect. Part of that can be washed away by taking the agency away from Agriculture and giving to its administration the authority necessary to keep it out of politics. The rest of the cleansing must come from REA itself in the manner in which it conducts itself.

REA was set up for the purpose of lending government money to those who would take electric service to farms that had been unable to get it from the utilities. In that capacity it acted for the government in protecting those loans. It was plain good business to insist that lines be of a certain standard of quality. Likewise, it was good business to help the co-ops to build load and to operate as efficiently as possible. So long as the government's interest was protected, however, it was not right or proper to limit the freedom of the co-ops in any way. If REA achieves independent agency status it should make that policy clear to all.

There has been a tendency, aggravated while under Agriculture, to make REA a public power advocate. This is a mistake because the co-ops have more to gain by working with the utilities than by antagonizing them. Nobody knows too much about rural electrification, but the private utilities have been in it longer and have more rural customers and can help their co-op customers. Cooperation is proving valuable in some states already and can spread elsewhere.

While the Senate investigation was pretty much a farce it may in the long run prove to have been of great value if by achieving independence REA can and will stick to the act under which it was set up and work not only to bring service to the farmer but to help him, in co-operation with all others working in the same direction, to learn how to use more electricity on the farm.

Post-War Competition of Gas and Electricity

IN ITS THIRD report the post-war planning committee of the American Gas Association, recognizing that electric cooking will be the basic challenge to the use of gas in the home after the war, suggests that this competitive battle can be avoided by recognizing that the two services are complementary. Unfortunately the gas industry's formula for dividing the business is very much like that well known formula for rabbit stew—one horse, one rabbit.

The gas committee's report states that in the modern kitchen electricity should be encouraged for those uses for which it is particularly suited, such as lighting, and power. The electrical industry, however, is not going to be content to serve in the kitchen only the load that gas cannot serve. If it is to achieve a goal of double-the-residential-usage or any other substantial increase it must greatly increase the use of electric cooking and water heating.

But there is another point which is much more important and that is the yardstick of service which federal power projects will set up. The gas report recognizes this when it calls attention to the "psychological effect" of the aggressive promotion of these projects "upon the rest of the nation in the public acceptance and demand for 'all electric' service."

Apportioning of the residential market between the gas and electric services will not produce an acceptable substitute for this yardstick of all electric service. In fact, just the opposite will result if the consumer feels that he has not had an adequate presentation of the case for electricity.

Not all combination companies have learned that the customer must be permitted to make a free choice and that every opportunity must be given him to know both sides. The desire to protect the gas investment is understandable, but what is gained if this serves to harm the greater and more profitable electrical investment because of unfavorable comparisons?

Combination companies have the same responsibility to the public for extending and encouraging electric service that they would have if the two were separated. In fact, their responsibility is even greater because the customer has no competitive service to turn to if dissatisfied.

The better way to meet the threat of competition from electricity, it seems to us, is through other measures suggested in the report, such as aggressive promotion and advertising, research, properly designed rates and improved appliances. This work has been very effective in the past.

In the meantime, the electric utilities might ask themselves how much further along the line of complete electric service in the home they might be five years from now if they had a unified program similar to that of the gas industry.

Diesel Operating Costs

IN A WEALTH of operating data in the latest A.S.M.E. report on oil-engine power cost there is given comprehensive information on about 53 utility plants of 500 to 15,000 horsepower of low-speed engine generators. These 1942 figures cover costs for fuel oil, lubricating oil, attendance (including supervision), supplies (including water), engine repairs and all other plant repairs in the item called total production cost.

From time to time proposals are heard for using oil-engine plants by utilities in areas served otherwise only by single transmission or sub-transmission lines. There are 16 such peak or standby plants in the A.S.M.E. report. The committee makes no breakdown and draws no conclusions but analysis of the data shows that 13 of them reflect an operating cost ranging from 6.6 to 70.02 mills per net kilowatt-hour with an average of 34.5 mills. This excludes three which have inordinately high values because of annual plant load factors of only one percent or less; in their cases the attendance cost represents half or more of the total operating cost. Whether utilities are warranted in going as high as 3 cents per kilowatt-hour for this class of service depends, of course, on the overall cost of service to the area when carrying charges are added and the whole lumped with the costs associated with the primary delivery over the power lines.

Base load operation of 21 plants in conjunction with steam, hydro or feed line quite naturally results in a lower operating cost because of the bettered load factor. These plants range from 6.6 to 25.45 mills with an average value of 11.71 mills per net kilowatt-hour output.

"Complete power" service, in most instances independent of other power units or power lines, for 13 of the utility plants results in an operating cost from as low as 3.81 mills to as high as 32.04, with an average of 13.39 mills.

Attention is called to these data not because they are conclusive—there are too few cases for that—but because they indicate how wide the variation can be from the best efficiency to the poorest or even the average. If these are the best results that can be obtained in utility plants by operators who are very much energy-cost conscious, what can be expected in the average or below average industrial with, if anything, poorer technical skills and direction?

Since most of the post-war diesel competition will be on the basis of operating costs, these data might be valuable in showing that there's many a slip between the salesman's estimated cost and the actual operating figures.

These Manufacturers Also Cooperated

BY INADVERTENCE—misplacement of some of the cards from which the list was compiled—the names of some twenty manufacturers were left out of the roll call of credit for cooperation in the survey of war-end market conditions published May 27. Though we were careful not to identify the source of any information, we did want to acknowledge the splendid cooperation which we had received from so many of our friends in answering all of our questions. While we realize that apologies do not cure injuries nor do corrections compensate for errors, we do wish to acknowledge the cooperation of the following companies whose names were omitted in the previous issue and ask their forbearance:

American Blower Corp.
Bussman Manufacturing Co.
Combustion Engineering Co.
Curtis Lighting, Inc.
Cutler-Hammer, Inc.
Delta-Star Electric Co.
Edison General Electric Appliance Co.
Electroline Co.
John E. Fast Co.
G & W Electric Specialty Co.
Grinnell Co.
James R. Kearney Corp.
Line Material Co.
W. N. Matthews Corp.
Moloney Electric Co.
Pacific Electric Manufacturing Co.
Reliable Electric Co.
Schweitzer & Conrad
Wagner Electric Co.
Worthington Pump & Machinery Corp.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

First Come, First Served Rural Extension Policy

THE OFFICE OF WAR Utilities has altered its regulations governing the approval of applications to construct rural lines in excess of 5,000 ft. so as no longer to invite competitive applications.

In place of the earlier practice, whereunder OWU went to considerable pains to assure itself that each such line cleared for construction consumed the absolute minimum of materials, the new rules provide that lines shall be constructed on a first-come-first-served basis.

No More Invitations to Apply

This is not to infer that the requirement that such lines be constructed as economically as possible is to be thrown out the window. OWU will still hold material authorizations down to the minimum, but it will no longer invite competing power sources to apply. Henceforth, the first person to apply for and who can justify a line will be allowed to build it, with no stop orders issued thereon because of materials considerations, unless the competitor can show that a substantial amount of materials stands to be consumed needlessly.

For some time, OWU has called attention of REA co-ops to applications filed by private companies, and vice versa. Its aim was to assure itself that farms which were eligible for service under existing standards got that service with the least possible consumption of materials.

Like many other well-intentioned and basically sound policies, this practice stirred up considerable ill feeling, particularly when it resulted in the construction of a line by the competitor of the power source which originally filed the application. That the practice continued as successfully as it did for as long as it did must be considered a tribute to the Power Division's reputation among private and co-op systems alike, for there are agencies in Washington which could never muster enough trust from the industries which they regulate to carry on such a plan for five minutes.

Under the first-come-first-served rule, OWU will process applications on the basis that no other application for the same territory will be forthcoming. When such original application appears to require more materials than are necessary, the applicant will be asked to bring it into line. Failing to do so, the applicant will be denied the right to build and will be advised to inform the prospective customers that the competitor is the only source of service under WPB regulations.

Competing Applications

When overlapping applications are in dispute as to materials, each applicant will be notified of the conflict and the dispute resolved before either is approved. When a protest is filed by a competing power source against an application in process, the complainant will be given up to 30 days in which to file his own application, provided that his protest is accompanied by a promise to submit such application. No application will be withheld from processing in anticipation of such protest, and original applications will maintain their priority during the settlement of a protest, although materials use will be the governing factor, of course. If an application has been cleared and approved before a protest or conflicting application is received, the action is final.

Having issued approval, OWU will reopen a case only on the ground of conflict with another WPB authorization, an allegation of misrepresentation, fraud or "unusual circumstances of the most compelling character." Allegations of fraud will be turned over to WPB's Compliance Division. Other reasons for reopening cases will be determined by OWU on their merits. Stop orders will not be issued unless overlapping applications have been approved inadvertently, or for similar good reason.

The Power Division does not intend to hold a stopwatch on competing applications. Any application which arrives while another covering the same territory is still in process will be checked on an equal basis with the original. The original will get the call if there is no substantial difference in materials. This provision will doubtless save OWU some headaches in the form of sloppily prepared applications. An application which is complete, is accompanied by maps and has its animal unit certification in good order, can go through the Power Division in 48 hours, with the average about twice as long. Poorly prepared applications can take the best part of a month. Letters or telegrams of intention will not be considered applications.

No Reservations

Nor will an application for a relatively small territory, which is later amended to cover a much vaster territory, reserve any rights or privileges to the large territory if a competitive application for the large territory has intervened, for the amended application will not be assigned the date of the original.

Finally, OWU has reaffirmed the WPB policy that priorities applications are strictly confidential, and that information contained in them may not be divulged except to authorized WPB officials. This, in conjunction with the foregoing rules, should suffice to settle complaints that private company applications are "reviewed in St. Louis," and vice versa.

By this process OWU is notifying both private companies and REA co-ops that it is sick and tired of the fighting and isn't going to hold brief for anybody. Cases such as those recently investigated by OWU will henceforth be investigated by WPB's Compliance Division, which will make its decisions strictly according to the book, untempered by any broad knowledge of the industry.

NEWS OF THE WEEK

United Industry Trend Appears at EEI Meeting

Action towards one association to represent all industry interests — Younger men come forward in revision of Institute constitution — More aggressive spirit arises in defense of free enterprise

From the serious excitment and the deep confidence in all minds on the first day of the Invasion, from the heartfelt prayer and the singing of the national anthem that opened the first session, there came to those attending the annual meeting of the Edison Electric Institute in New York this week added strength in the purpose of keeping the industry one of American free enterprise. Indications of that purpose were strikingly apparent in the papers and addresses and in two important actions taken. The first of these was passage of resolutions aiming at consolidation of industry associations into one effective organization. The second was a change in the constitution of the Institute and the election of officers in conformance with it. Significance of this action lies in its large admission of younger men into industry policy determination, as may be seen from the accompanying list.

Action towards consolidation of the Institute, the Association of Edison Illuminating Companies, the Council of Electric Operating Companies and the Advertising Committee into one association that would effectively represent the industry in all interests was taken in the first session on motion of C. L. Campbell, Connecticut Light & Power, who asked for recognition from the floor. Mr. Campbell's motion pointed out the existence of the four separate organizations, the division of the industry in membership in them, the possible advantages of economy in their merger and the probability that future conditions are likely to be such as can be met best by a single agency representing the whole industry. The resolution adopted provide for the appointment of a joint committee representing the four groups and that larger utilities not affiliated with any of them be invited to appoint men to the committee to represent them. The committee is then to study into the whole subject and report to the organization participating for such further action as shall be deemed wise.

Urging upon management to consider, always, area- and community-wide planning of rural service, G. V. Rork, Northern States Power, said that the question before the utilities today is not whether farm service can stand on its own feet in business terms but is one of developing it to the point of firm footing. Construction of rural extensions is no longer the engineering problem it once was; the concern now is to make electricity the "farmer's best hired man." To this end Mr. Rork advised that line extension rules be examined and conformed to local desires and conditions as revealed by survey. They should be simplified so that customers can understand them and liberalized to allow ample money to remain in the hands of farmers to pay for adequate wiring and useful equipment. Rate structures should be reviewed carefully and complicated calculations eliminated. And intensive effort should be given to promoting the multifarious uses of electricity in modern farming. Foresight and faith are necessary that agriculture can flourish as an industry

ATTENDANTS AT EEI MEETING—(left to right: Edwin Vennard, Middle West Service; Merrill E. Skinner, Buffalo Niagara Electric; J. Eugene Tanguay, Quebec Power; E. C. Stone, Duquesne Light; H. S. Bennion, Edison Electric Institute

ACTIVE PARTICIPANTS IN PRE-MEETING DELIBERATIONS—(left to right): J. W. Parker, Detroit Edison; R. L. Thomas, Consolidated Gas, Electric Light & Power of Baltimore; R. H. Knowlton, Connecticut Light & Power; C. H. Latham, Monongahela West Penn and W. H. Sammis, Commonwealth & Southern

sustaining itself and furnishing sustenance to the nation.

Important among the reasons why the country-wide safety record of the electric utilities does not show progress over the past ten years, said H. O. Sprinkle, chairman of the E.E.I. accident prevention committee, are that safety rules are not properly enforced and that top management does not do its share of the job. The safety director does not have exclusive responsibility for accident prevention; management must express its interest effectively by actual time spent in checking up accident prevention performance by all concerned.

"Our bureaucratic planners are striking at the very bulwark of democracy under the guise of a military defense of that principle. They are laying the groundwork for disregard of the established constitutional law of the land; they belittle justice and defame the dispensers of law and order. They seek to destroy the affections of the people of this country for established insti-

Counsel on Collective Bargaining

Important points that utility management should consider in its fundamental policy on collective bargaining were stated by H. K. Breckenridge, chairman of the E.E.I. industrial relations committee, at the annual meeting of the Institute this week. They are:

1. Its policy on recognition, including whether or not to insist upon Labor Board certification.

2. The definition of "bargaining units." These may be so defined as to parallel regular organizational lines within the company and thereby simplify the handling of grievances. They may, however, be greatly complicated by the fact that employees have chosen various units to represent small groups of employees in the same general department.

3. Management needs to define who are supervisors, and draw as clearly as possible the line between management representatives and men eligible for membership in unions. This is a matter which has caused considerable concern lately, especially in view of the national publicity on the strikes of foremen in the Detroit area. It would seem to be clear that the public does not sympathize with the desire of unions to include supervisors, recognizing the impossibility of carrying out the job of supervising with men who are part of the bargaining agency which includes the employees supervised.

4. No-strike clauses appear in most utility agreements, and most managements have been successful in convincing unions that the public interest inherent in our business permits of no strikes in settlement of our labor disputes. It seems to me important that we recognize that this is a continuing obligation in our business, and not a temporary wartime situation.

5. Sound and practical grievance machinery is an essential for the orderly operation of union contracts. Management needs to see that the grievance machinery operates smoothly, with no undue delays, and is not made too complicated. Cumbersome grievance machinery not only takes an unnecessarily large amount of management's and employees' time, but tends to delay settlement of grievances or even create new ones.

6. The grievance procedure normally leads to the ultimate settlement of disputes by arbitration, and management needs to give thought to the most practical method of arbitration, establishing it by agreement with the union before the parties are faced with an issue.

7. The addition of merit rating to the wage structure, to a practical degree, is a matter about which management needs to do considerable advance planning. Without a clearly-defined and understandable method of determining merit, the tendency of unions, is to insist that wage structures either contain a single rate for each job, or if a rate range is used to insist that automatic increases be provided over relatively short periods of service. Management's job in this connection is to devise merit rating plans which can be "sold" to employees as fair and reasonable, and which will be practical in administration.

8. The question of union security seems to be reasonably well settled for the duration of the war by the War Labor Board policy of granting maintenance-of-union-membership clauses in dispute cases brought before the Board. Unions are naturally concerned about being able to hold their wartime gains. Managements are generally firmly against being required to make union membership a condition of employment. With all of the limitations of the maintenance-of-membership provision, and the fairly united opposition to it on the part of employers, it may be fortunate that the War Labor Board's policy has largely removed this particular issue from collective bargaining during the war.

9. Another important consideration in meeting the collective bargaining problem efficiently is understanding on the part of management of the real desires of the union leaders and the union membership. Sometimes the real desires of employees are not apparent from the list of demands made on the company in a contract negotiation, and it may take many days of discussion to develop what issues are of paramount importance to the employees who are represented by the union. Until management is convinced of the issues which the union considers the most important, it is difficult to do any intelligent collective bargaining. Without such understanding management may easily make concessions which have no substantial value in the inevitable trading which seems to be a part of the bargaining process.

tutions and customs." Thus spoke Donald D. Conn, Transportation Association of America in his address, "Public Services—the Bulwark of Private Enterprise." If those who believe in free enterprise do not join together to resist, they will separately become "easy prey for the three-way attack, investigation to discredit, regulation to control and government financing or corporations to compete."

A singularly lucid discussion of an abstruse subject, the paper, "Depreciation Accounting Innovations from the Viewpoint of the Investor", by Philip L. Warren, showed how the theory of deduction of depreciation reserve from original cost to arrive at the rate base must inevitably destroy confidence of investors in utility securities. Such whittling away at the rate base, progressively reduces the earning power of capital invested in the industry and will result finally in wiping it out entirely if carried through without change. With that prospect clearly in view, it is not to be expected that utility securities, particularly common and preferred stocks, should appear attractive to investors.

Cooperatives Proliferate

"If independent business men do not soon awake to the dangers that confront them, their days are most certainly numbered." Thus spoke Ben C. McCabe, president of the National Tax Equality Association. He told particularly of the rapid growth of cooperatives which now have an annual business volume of nearly four billion dollars. They own grain elevators, flour mills, coal and lumber yards, packing houses, stores, printing plants, newspapers, telephone utilities, banks, insurance companies and even undertaking establishments; it is becoming difficult to find a line of business into which they are not moving. This rapid growth has resulted from tax exemptions and from freedom from government controls in regard to monopoly, security sales, rebates and other trends and practices vigorously reprobated in individual enterprise. They have been encouraged and given preference by government in many different ways, including loans on most favorable terms. This mushroom growth, plus the government investment of over fifteen billion dollars in factories for war production and the three to four billion of government money in electric and other utilities, constitute a threat to free enterprise that can not be ignored.

Present-day problems in industrial relations that face the utilities were comprehensively reviewed in the paper, "Manpower and Labor Trends", by H. K. Breckenridge, West Penn Power. Included were discussions of the demands of Selective Service on present personnel, making best use of available manpower, return of employees from the armed services, collective bargaining and maintenance of employee morale. Mr. Breckenridge said:

"Good employee morale is not purchased by a wage increase or other benefit, and it is not necessarily a result of there being or not being a union. It seems to depend largely upon how much confidence employees have that their boss is fair and that their company is soundly managed. It is the sum total of employee relations job of top management and every supervisor."

Principal point of the discussion of Mr. Skinner's paper on post-war business (abstracted elsewhere in this issue) by H. C. Thuerk, New Jersey Power & Light, was the question of consolidating industry activities, technical, commercial, publicity and others, into one national association.

New Officers

After the necessary change in the constitution had been adopted the following directive personnel was elected.

Officers: C. W. Kellogg, President; J. W. Parker, Vice President, The Detroit Edison Co.; H. B. Bryans, Vice President, Philadelphia Electric Co.; H. S. Bennion, Vice President and Managing Director; Gilbert W. Chapman, Treasurer, American Water Works and Electric Co.; Mae B. Woods, Secretary.

Members of Board of Directors elected for one year: H. B. Bryans, Philadelphia Electric Co.; R. E. Dillon, Boston Edison Co.; J. G. Holtzclaw, Virginia Electric & Power Co.; R. H. Knowlton, Connecticut Light & Power Co.; Frank McLaughlin, Puget Sound Power & Light Co., W. E. Mitchell, Georgia Power Co.; W. C. Mullendore, Southern California Edison Co.; W. H. Sammis, The Commonwealth & Southern Corp.; Philip Sporn, American Gas & Electric Co.; L. V. Sutton, Carolina Power & Light Co.; E. S. Thompson, American Water Works and Electric Co.; G. W. Van Derzee, Wisconsin Electric Power Co.; P. S. Young, Public Service Electric & Gas Co.

Members of Board of Directors elected for two years: H. C. Blackwell, Cincinnati Gas & Electric Co.; W. H. Burke, Ebasco Services, Inc.; William Kelly, Buffalo Niagara and Eastern Power Corp.; Frank Kruesi, Middle West Service Co.; R. E. Moody, Union Electric Co.; J. W. Parker, The Detroit Edison Co.; H. T. Pritchard, Indianapolis Power & Light Co.; K. M. Robinson, The Washington Water Power Co.; E. C. Stone, Duquesne Light Co.; R. L. Thomas, Consolidated Gas Electric Light & Power Co.; William Webster, New England Power Association; A. Emory Wishon, Pacific Gas & Electric Co.; H. E. Young, Northern States Power Co.

Members of Board of Directors elected for three years: J. M. Barry, Alabama Power Co.; W. C. Bell, United Illuminating Co.; G. A. Davis, Oklahoma Gas & Electric Co.; G. M. Gadsby, Utah Power & Light Co.; R. D. Jennison, New York State Electric & Gas Corp.; F. C. Kellogg, Public Utility Engineering & Service Corp.; G. L. MacGregor, Dallas Power & Light Co.; J. H. Polhemus, Portland General Electric Co.; P. H. Powers, West Penn Power Co.; C. C. Smith, Kansas City Power & Light Co.; F. M. Wilkes, Southwestern Gas & Electric Co.; J. S. Wise, Pennsylvania Power & Light Co.

Members of Executive Committee: H. B. Bryans, Philadelphia Electric Co.; W. H. Sammis, The Commonwealth & Southern Corp.; P. S. Young, Public Service Electric & Gas Co.; W. H. Burke, Ebasco Services Inc.; William Kelly, Buffalo Niagara & Eastern Power Corp.; E. C. Stone, Duquesne Light Co.; W. C. Bell, United Illuminating Co.; P. H. Powers, West Penn Power Co.; J. S. Wise, Pennsylvania Power & Light Co.

Members of Advisory Committee: P. S. Arkwright, Georgia Power Co.; D. C. Barnes, Engineers Public Service Co.; H. J. Bauer, Southern California Edison Co.; S. R. Bertron, Houston Lighting and Power Co.; J. B. Black, Pacific Gas & Electric Co.; John W. Carpenter, Texas Power & Light Co.; C. M. Cohn, Consolidated Gas Electric Light & Power Co.; E. G. Crawford, Cleveland Electric Illuminating Co.; T. D. Crocker, Northern States Power Co.; J. E. Davidson, Nebraska Power Co.; Samuel Ferguson, The Hartford Electric Light Co.; J. F. Fogarty, North American Co.; P. G. Gossier, Columbia Gas and Electric Corp.; C. E. Groesbeck, Electric Bond & Share Co.; H. P. Liversidge, Philadelphia Electric Co.; B. W. Lynch, San Diego Gas & Electric Co.; A. C. Marshall, The Detroit Edison Co.; T. W. Martin, Alabama Power Co.; P. H. McCance, Duquesne Light Co.; William McClellan, Union Electric Co. of Missouri; Irvin L. Moore, New England Power Association; A. B. Paterson, New Orleans Public Service, Inc.; H. Hobart Porter, American Water Works and Electric Co.; Paul Schoellkopf, Buffalo Niagara and Eastern Power Corp.; P. L. Smith, The Middle West Corp.; George N. Tidd, American Gas & Electric Co.; J. V. Toner, Boston Edison Co.; E. W. Wakelee, Public Service Electric & Gas Co.; S. B. Way, Wisconsin Electric Power Co.; J. R. Whiting, the Commonwealth & Southern Corp.

The Reddy Kilowatt prize award for excellence in annual report to stockholders and employees went to the Puget Sound Power & Light Co.; honorable mention to Kansas Gas & Electric Co. and Duquesne Light Co. First place in the Laura McCall award in home service activities was won by Union Electric of Missouri, $150 war bonds to Esther Lee Bride; second, Appalachian Electric Power, $100 bond to Mrs. Selma M. Andrews; third, Potomac Electric Power, $75 bond to Mary E. Turner; fourth, Texas Power & Light, $50 bond to Jamer H. Apperson; fifth, Central Vermont Public Service, $25 bond to Mrs. Lillian B. McGill.

"Death Sentence" Will Be Reviewed by High Court

Agrees to pass upon decision of Federal Court of Appeals in Engineers Public Service case — Also will study two points raised by SEC in divestment order

A Supreme Court decision on the constitutionality of the "Death Sentence" clause of the Public Utilities Holding Company Act was in prospect this week after the Supreme Court agreed to review a decision of the District of Columbia appeals court which upheld the clause.

Twin Writs of certiorari were granted by the high court as the Engineers Public Service Co., which had been ordered by the Securities and Exchange Commission to divest itself of utility properties valued at $30,000,000, and SEC, which had been overruled by the District Appeals Court on two points in its divestment order, sought high court review. While upholding the "Death Sentence" clause in its decision, the District Appeals Court had remanded the case to SEC for correction of the two points it deemed erroneous.

Clarification Sought

U. S. Solicitor General Charles Fahy, on behalf of SEC, asked the high court to review two findings of the District Appeals Court to which the case was taken directly after SEC's orders were issued. Fahy asked that the high court determine whether SEC was within its rights in ordering Engineers to divest itself of transportation properties operated in conjunction with its Virginia Electric & Power Co. power system and whether SEC can properly designate the single integrated utility system which Engineers shall be allowed to retain (Virginia Electric).

The Appeals Court had ruled against SEC on these two sections of its orders against Engineers, and remanded the case to SEC on this basis.

Engineers appealed to the high court seeking determination of:

1. Whether section 11 (b) (1) is a proper exercise of congressional power to regulate interstate commerce.

2. Whether this section violates the due process clause of the Fifth Amendment.

3. Whether the commission should have allowed it (Engineers) to submit evidence to show that section 11 (b) (1) is arbitrary and unreasonable in that it has no real relation to the purposes of the act.

4. Whether clause (B) of section 11 (b) (1) requires that all integrated public utility systems controlled by one holding company, including its "single system" shall be located in one geographical area.

5. Whether clause (A) of section 11 (b) (1) requires something more than proof of substantial savings in operational expenses resulting from retention of control by the holding company.

Engineers petitioned despite the fact that the orders were remanded to SEC because the Appeals Court ruled against it on these points.

SEC in its appeal to the high court argued that the District Appeals Court, in ruling that SEC misinterpreted the "other businesses" clause of section 11 (b) (1), came in conflict with the decision of the second Circuit Court of Appeals in the North American Case. In the North American Case, the second appeals court held that other businesses may be retained only when it affirmatively appears "that the public interest will be furthered by retention of a non-utility interest. . . ."

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REA Investigation Closed by Senate

Hearings before the Senate Agriculture Committee investigating the Rural Electrification Administration were terminated last week, apparently for good, but conflicting statements by committee members raised some question as to future activity of the group.

It was agreed that a report on the six-months-long investigation would be drawn up, recommending that REA be restored to independent status, with legislation to accomplish this introduced when the report is made. The committee will remain in existence to receive any further statements which may be laid before it, and one member indicated that it was seeking certain specific information on several undisclosed matters.

One member hoped that the report would be turned in before Congress recesses later this month, but another indicated it would be some months away.

The allegation of forgery of a committee exhibit apparently was of little concern, for one member said it was washed up" while another said the committee would meet and decide whether anything further should be done. Both agreed that if the committee pursues it farther, which is believed unlikely, it will refer the matter to the Justice Department.

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Legislative Log-Jam Evolves in Capital

The Senate Commerce Committee included in its amendments to the Rivers and Harbors bill reported to the Senate recently an amendment giving Interior Secretary Harold L. Ickes authority to market surplus power generated at all power plants provided in the bill. It had been reported incorrectly in ELECTRICAL WORLD (June 3, 1944, p. 3.) that the committee had rejected the amendment, giving Ickes marketing authority only over the Snake River and Umatilla power.

The committee also amended the Snake River project to include all 10 proposed dams rather than just four. At least three power plants, with a total capacity of 155,000-kw. are included in the project.

It was believed that the committee would amend the Flood Control bill, now before it, to include the Ickes power marketing amendment.

The House and Senate were deadlocked on the McKellar amendments to the Independent Offices Appropriation bill early this week after the lower body again refused to concur with Senate proposals that the Tennessee Valley Authority's revolving fund be junked and all its employees earning in excess of $4,500 yearly be subject to Senate confirmation.

The legislative clock, meanwhile, was running out, since all appropriation bills should be law by the start of the new fiscal year on July 1. Complicating the situation was the Republican national convention, scheduled for June 26, before which Congress hopes to recess for an indefinite period. Since both the Agriculture and Interior Department appropriation bills are still in conference and several other appropriation bills are still before one of the two Houses or also in conference, a real legislative log-jam was developing. Considerable disagreement over Senate amendments to the Agriculture and Interior bills was expected.

Utility Manpower Status To Be Decided Locally

Hiring of male workers must be made through USES or approved agency after July 1 on terms stipulated by WMC committee — Employment ceilings extended

Local manpower committees will determine the standing of electric utilities in the new regulations governing the hiring of male workers after July 1.

After that date, all hiring of male workers will be through the United States Employment Service or through an agency approved by USES and on terms stipulated for the area, region or city by a duly authorized War Manpower Commission committee.

In addition, employment ceilings which are now in effect in about 25 cities will be extended to all Group I and II labor areas, (areas of acute and serious labor shortages respectively). Ceilings will permit additional hiring up to specified limits, freeze employment at current levels or freeze employment below current levels, and may be applied to all workers or only to male workers, as the local committee determines to be necessary. Manpower priorities committees will be set up in each of the 184 Group I and II areas to determine these problems. Elsewhere in the country, the program will be handled by USES local offices.

Theoretically, USES could prevent the hiring of a jobless male who refused to take any of the jobs to which it referred him, but cases so drastic are not expected to arise. USES will refer workers to jobs with the highest war priority and work down the list of urgent jobs as a worker refuses higher-rated positions. The plan is calculated to move idle workers out of areas in which surplus labor is available and into labor shortage areas, but exceptions under which workers can refuse to move are so broad that it is not anticipated that any appreciable forced migration will be indulged in.

Veterans returned to civilian life will have 60 days in which to take any job they choose, and thereafter will be subject to hiring through USES.

The new program logically would benefit electric utilities since insofar as referrals are made in order of job importance, utilities will rate higher than certain other jobs which have attracted men in the past.

National Selective Service, meanwhile, moved to bring its replacement schedule program into line with the most recent changes in draft policy. Hereafter, no new replacement schedules will be accepted, and existing schedules will be renewed for only one more six-month period. Such renewals will require approval of the National Draft Director. Existing schedules will have meaning primarily only for men between 25 and 30, since deferments are not available for men under 26 and are easily available for men over 29 who are employed in the electric power industry.

WMC, meanwhile, has added Savannah, Ga., and Bern, N. C., to its list of Group I labor areas and moved Newton, Ia., from Group I to Group II.

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FPC Closes "Southwest Power Pool" Rate Case

Federal Power Commission has terminated proceedings in the investigation of the rates and charges involved among the ten electric utilities comprising the "Southwestern Power Pool" following a finding that such rates are not unjust, unreasonable, unduly discriminatory or preferential for the period ending June 30, 1944, which is the expiration date of the intercompany agreement.

The ten-company pool was formed pursuant to an arrangement dated December 16, 1941, to enable Arkansas Power & Light Co. to supply electric energy to DPC's aluminum reduction plant at Lake Catherine, Ark. Investigation of the agreement was instituted by the commission through an order adopted in September, 1942, and hearings in the matter were held at Little Rock in December, 1942 and January and February, 1943.

The commission also found that the rates involved in the contract between Arkansas Power & Light Co. and DPC for the supply of electric energy to the aluminum plant are not subject to regulation by the commission under the Federal Power Act.

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Madera Canal Opened

With the opening of an 84-inch needle valve water began to flow on June 4 into the Madera Canal in the San Joaquin Valley, California, from a reservoir created by Friant Dam at public ceremonies attended by citizens and public officials. The event signalized a step toward the ultimate completion of the great Central Valley irrigation and power project on which has been spent so far more than $150,000,000.

DESIGNED FOR BILLING—Executives of Consolidated Edison Co. of New York inspect device of George J. Beswick which won the highest award yet made by the company's suggestion commitee—$500. Left to right: R. B. Grove, vice-president; J. F. Rooney, general commercial manager; Mr. Beswick, and F. V. Magalhaes, chairman, suggestion committee. The device eliminates the possibility of human error in the method of making 200,000 computations a month in billing for periods which are longer or shorter than the regulation meter reading periods

Detroit Edison Asks Court Rehearing

Michigan utilities oppose plan to void 1944 excess profits taxes by rate reductions at Detroit conference held this week

An application for rehearing by the state supreme court on its recent decision in the case of the City of Detroit versus the Michigan Public Service Commission (ELECTRICAL WORLD, May 27, page 95 and June 3, page 9) was requested at Lansing this week by the Detroit Edison Co.

City and Detroit officials, and apparently the commission, Prentiss M. Brown, chairman of the board of the Edison company, said "read the Supreme Court decision as a hard and fast rule forbidding a public service company to charge war taxes as a part of operating expenses and this matter is so important that we have asked for a rehearing to clarify this main issue . . . Whether or not the war tax we are required to pay can be considered an operating expense is most important to us and to every public service company in the country. If it is not considered an operating expense, it is difficult to see how any public service company can pay such taxes without impairing its financial soundness. The war taxes which are called excess profits taxes are nothing more or less than another form of income tax applied to corporations, instead of the graduated income tax applied to individuals.

"No Excess Profits"

"Excess profits have risen largely from government contracts where prices are fixed by negotiations between government and the contractor. We have no excess profits Our rates are definitely limited by the determination of the Public Service Commission. The general price level or cost of living has risen 26 percent, according to the latest figures, as a result of the heavy war demand for materials and their very limited supply. This price level increase permits business concerns generally to absorb their excess profits taxes. We have not been allowed, nor have we asked for, any increase of rates to absorb them. Therefore, we think it logical, fair and just that our excess profits taxes should be considered a business expense. We hope the rehearing for which we are applying will settle this point."

Major public utility companies of Michigan formally opposed any plan to cut their rates to consumers to avoid 1944 payments of federal excess profit taxes at the June 1 conference called by the Michigan Public Service Commission as a result of the Supreme Court decision.

Company executives argued that while excess profit taxes may be considered in fixing rates, the court avoided any declaration that rates must be cut in order to forestall excess profit taxes.

Detroit Edison Co., Michigan Consolidated Gas Co., and the Consumers Power Co. were among the big companies which doubted that rates should be cut. All of them emphasized that present high revenues depend largely on war plant activities, which may end suddenly. Asked by the commission to indicate whether rate adjustments could be made to avoid the federal tax, Prentiss M. Brown, chairman of the board of the Detroit Edison said:

"We cannot state any such adjustment because it is impossible to forecast a continuance of the heavy war time demand for service."

John W. Batten, president of the Michigan Consolidated Gas Co., argued that his company's return on its investment already is low and any rate reduction might impair its ability to serve the public.

Consumers Power Co. argued that the present revenue level is temporary and not a proper basis for rate changes. Both Michigan Consolidated and Detroit Edison officials said a Detroit ordinance imposing a 20 percent excise tax on their gross profits, is a confusing element in the picture. They contended that the city should drop the ordinance, validity of which is now a matter of litigation, if their rates were cut. City officials declined to discuss the matter pending the June 8 conference with the commission and the local Detroit utilities.

Gilbert T. Shilson, the Public Service Commission chairman, said the June conference is intended to get the views of all utilities on the rate adjustments which may be possible under the court decision. He said the session is preliminary to a conference June 8 with the Detroit Edison and city of Detroit officials.

"We hope to get a rule on rate adjustments which will be applicable to all companies," he said. "If adjustments can be negotiated adjustments can be made any time to avoid the 1944 excess profits tax payment. If we are forced to hold rate hearings we cannot handle all of them this year and rate adjustments for 1944 may be impossible in many cases."

MEETINGS

Previously Listed

National District Heating Association — Annual meeting, William Penn Hotel, Pittsburgh, Pa., June 14-15. John F. Collins, Jr., secretary-treasurer, 827 N. Euclid Ave., Pittsburgh, Pa.

Iowa Utilities Association—Post-war planning conference, Des Moines, Iowa, June 19-20. Wm. R. Blake, secretary-manager, 606 Fleming Bldg., Des Moines, Iowa.

American Society of Agricultural Engineers—Annual meeting, Schroeder Hotel, Milwaukeee, Wis., June 19-21. Raymond Olney, secretary, St. Joseph, Mich.

American Society of Mechanical Engineers—Semi-annual meeting, William Penn Hotel, Pittsburgh, Pa., June, 19-22. Ernest Hartford, executive assistant secretary, 29 W. 39th St., New York 18, N. Y.

Canadian Electrical Association—Annual meeting, Murray Bay, Que., Canada, June 22-23. B. C. Fairchild, managing director, 704 Tramways Bldg., Montreal, Que.

Society for Promotion of Engineering Education—Annual meeting, University of Cincinnati, Cincinnati, Ohio, June 22-25. F. L. Bishop, secretary, University of Pittsburgh, Pittsburg, Pa.

American Society for Testing Materials—Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., June 26-30. Robert J. Painter, assistant secretary, 260 S. Broad St., Philadelphia 2, Pa.

American Institute of Electrical Engineers — National technical meeting, Jefferson Hotel, St. Louis, Mo., June 26-30. Pacific Coast technical meeting, Biltmore Hotel, Los Angeles, Calif., August 29-September 1. H. H. Henline, national secretary, 33 W. 39th St., New York 18 N. Y.

International Association of Electrical Inspectors—Northwestern section, Olympian Hotel, Olympia, Wash., August 21-23; E. B. Morrison, secretary, P.O. Box 70, Portland, Ore. Southwestern section, Modesto Hotel, Modesto, Calif., August 28-30; H. L. Gerber, secretary, Room 205, City Hall, San Francisco, Calif. Western section, Claypool Hotel, Indianapolis, Ind., September 11-13; F. H. Moore, secretary, 320 N. Meridian St., Indianapolis, Ind. Eastern section, New York, N. Y., September 18-20; F. N. M. Squires, secretary, 85 John St., New York, N. Y. Southern section, Ainsley Hotel, Atlanta, Ga., September 25-27; A. M. Miller, secretary, 219 Governor St., Richmond 19, Va.

Niagara Hudson Appeals

Application for judicial review of the State Public Service Commission's refusal to permit consolidation of the eight companies of the Niagara Hudson system has been filed in the State Supreme Court. The petition stated the commission's decision was "arbitrary and capricious and constitutes a confiscation of the property of petitioners."

The commission ruled January 25 that the proposed "unification plan as presented would not be in the public interest." A reorganization of the present system was ordered by the SEC.

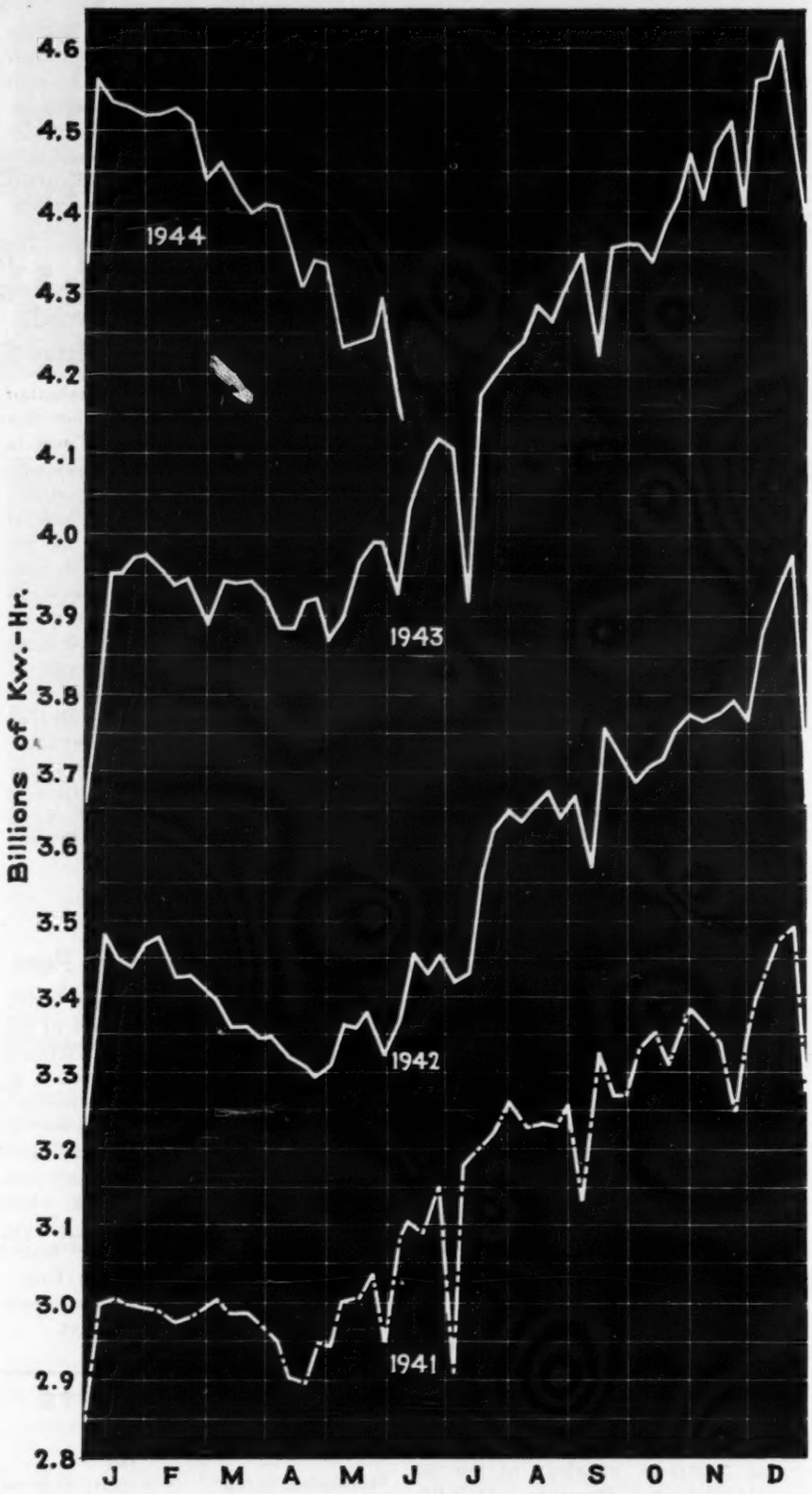
Utility Deal Approved

Missouri Public Service Commission has approved the sale of the Maryville Electric Light & Power Co. to the Missouri Power & Light Co. for $1,271,288. It also authorized the sale of Missouri Power & Light to the Continental Gas & Electric Co. of Chicago for $3,729,800.

Output Declines in Holiday Week

The holiday-shortened Decoration Day week ended June 3 brought a drop in the output curve, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry during the week came to a total of 4,144,490,000 kw.-hr., as compared to the figure of 4,291,750,000 kw.-hr. for the week previous which ended on May 27. Figures for the week represented an increase of 5.6 percent over the 3,925,893,000 kw.-hr. distributed during the corresponding week a year ago. The output for the similar week two years ago was lower, the total being 3,372,374,000 kw.-hr.

Three of the seven major geographic regions of the country reported decreases for the week as compared with the corresponding week last year. The New England states showed a drop of 1.2 percent; the Rocky Mountain group of 11.2 percent and the Mid-Atlantic states 0.2 percent for the week ended June 3. Gains reported by the Central Industrial and West Central states the preceding week were reduced somewhat during the week ended June 3, while the Southern states and the Pacific Coast states increased their leads.



Weekly Output Millions Kw.-Hr.

1944		1943		1942	
June 3	4,144	June 5	3,926	June 6	3,372
May 27	4,292	May 29	3,990	May 30	3,323
May 13	4,238	May 15	3,969	May 16	3,357
May 6	4,234	May 8	3,904	May 9	3,365
Apr. 29	4,336	May 1	3,867	May 2	3,305
Apr. 22	4,344	Apr. 24	3,925	Apr. 25	3,273
Apr. 15	4,307	Apr. 17	3,917	Apr. 18	3,308
Apr. 8	4,361	Apr. 10	3,882	Apr. 11	3,321
Apr. 1	4,409	Apr. 3	3,890	Apr. 4	3,349
Mar. 25	4,409	Mar. 27	3,928	Mar. 28	3,346
Mar. 18	4,400	Mar. 20	3,947	Mar. 21	3,357
Mar. 11	4,426	Mar. 13	3,945	Mar. 14	3,357

Percent Change from Previous Year

	Week Ending		
	June 3	May 27	May 13
New England	— 1.2	+ 2.7	+ 0.7
Mid-Atlantic	— 0.2	+ 5.1	+ 4.0
Central Industrial	+ 4.4	+ 7.2	+ 5.5
West Central	+ 5.7	+ 8.2	+ 4.4
Southern States	+10.4	+ 9.4	+ 7.4
Rocky Mountain	—11.2	— 8.2	— 9.4
Pacific Coast	+16.0	+14.5	+19.8
Total United States	+ 5.6	+ 7.6	+19.8

March Revenues Increase, Taxes up 7% in 1944

Electric operating revenues of the larger privately owned electric utilities in the United States in March, 1944, were $260,169,000, compared to $238,368,000 in March, 1943, an increase of 9.1 per cent, according to a report issued by the Federal Power Commission. Revenues from sales to ultimate consumers were up 9.2 percent to $235,780,000 and electric operating revenue deductions (including operating expenses, depreciation and taxes) were $202,684,000.

Revenues by classes of service in March, 1944, compared with the same month of 1943 were as follows: industrial, an increase of 10.4 percent; residential, plus 8.7 percent; and commercial, plus 8.3 percent.

Total taxes charged to electric operations of the larger privately owned electric utilities in the first quarter of 1944 were $190,625,000, compared to $177,973,000 in the first quarter of 1943 an increase of 7.1 percent.

OCR Survey Reveals Appliance Demands

Retail demand for 22,619,692 domestic electric appliances ranging from washing machines to toasters was found by U. S. Census investigators who recently completed a third nationwide survey of consumer requirements for WPB's Office of Civilian Requirements.

Washing machines, irons and mechanical refrigerators in that order were found to be most widely desired in the survey which Director William Y. Elliott of OCR said "indicates that when appliances become available again, there should be an orderly market rather than the wild buying rush which some people have predicted."

An estimated 3,684,996 families will be in the market for new homes, either built or purchased, the survey disclosed, with the average price estimated at $4,400. The housing demand, the report indicated, would remain strong over several years and would furnish a continuing demand for appliances.

An estimated 4,261,560 buyers would purchase washing machines, according to the survey. Other appliances and estimated markets therefore include: irons, 4,019,236; refrigerators, 3,827,048; electric ranges, 493,004; toasters, 3,200,348; radios, 2,682,276; vacuum cleaners, 2,389,816; fans, 1,487,368, and electric water heaters, 259,036.

Elliott said the report indicated that domestic appliances have been conserved well and that the indicated demand is for legitimate replacement needs or from households which did not have such appliances before the war halted their production.

Meanwhile, WPB has authorized production of another 421,500 irons, bringing the total authorized out of the projected 2,000,000 to be produced to 1,374,938. The authorization went to General Electric's Ontario, Calif., plant.

•

Urge Surplus Motors Sale in Foreign Markets

Production of fractional horsepower electric motors is sufficient to fill existing programs, members of the industry's advisory committee told WPB recently, but additional motors for civilian production are not immediately in sight because of the huge military orders.

Members of the Integral Horsepower Electric Motor Manufacturing Industry Advisory Committee, meanwhile, urged that sale of surplus motors in foreign markets be encouraged. They pointed out that such sale would cut down the surplus ultimately to be thrown on the market against which new motor manufacture would have to compete. It was suggested that prospective purchasers be asked to specify their demands in such fashion that they could be matched up with available surpluses and filled more readily.

•

H. & M. Fare Rise Allowed; Effective Date Delayed

Although the Hudson & Manhattan Railroad Co. received permission this week from the U. S. Supreme Court to raise its fares immediately, company officials announced that the actual rise would not go into effect for several weeks. In this recent action the Supreme Court granted an H. & M. petition, asking that the court's recent ruling, raising the fare on the downtown line between Jersey City from 8 cents to 10 cents, become effective at once.

On May 29 the high court set aside a decision of the United States District Court in Newark, N. J., which last January prohibited the railroad from putting into effect fare rises authorized in August, 1943, by the Interstate Commerce Commission (ELECTRICAL WORLD, June 3, page 3).

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Utah Upholds Mexico Pact

Approval of a pending treaty which would allocate to Mexico waters of the Colorado, Rio Grande and Tiajuana rivers (ELECTRICAL WORLD, April 8, p. 21) was voiced by Utah when representatives of irrigation water users met in Salt Lake City May 25 and affirmed ratification of the pact. Lined up with Utah are Colorado and Arizona, while California and Nevada are raising strong objections to the treaty. Water users' vote was transmitted to Utah's members of the western states advisory committee to the state department.

UTILITY REPORTS

	Net Income 1944	1943
*Birmingham Electric	$1,215,591	$1,395,863
*Carolina Power & Light	2,555,340	2,369,447
*Central Arizona Lt. & Pwr.	868,163	903,741
†Duquesne Light	10,540,401	11,025,174
*Kansas Gas & Electric	1,413,824	1,516,963
*Minnesota Power & Light	1,892,036	1,834,260
*Montana Power and subs.	4,310,017	3,546,794
*Nebraska Power	1,647,516	1,779,532
*Pennsylvania Power & Light	5,711,149	5,749,881
*Sierra Pacific Power	576,913	568,364
†Southern Colorado Power	331,104	333,890
*Tampa Electric	1,161,469	1,196,336
*Texas Electric Service	1,726,800	1,895,869
*Texas Power & Light	2,727,871	2,281,421

*Twelve months ended April 30.
†Twelve months ended March 31.

Compromise Offered on Vermont Plan

Army proposals for installation of power facilities in Vermont as part of the projected $57,000,000 flood control program for the Connecticut River basin were in danger this week after Vermont residents wrung from a Senate Commerce subcommittee an offer to eliminate one dam completely and to discard power facilities at others within the state.

Sen. John H. Overton, Louisiana Democrat and subcommittee chairman, offered a compromise under which the West Dummerston dam would be eliminated and no power facilities put in at other dams to be erected within the state. Opposition to the installation of power facilities was crystallized before the subcommittee by a group of Vermonters who dubbed themselves Freemen, Inc., and who appeared with the backing of Sen. George D. Aiken and Sen. Warren R. Austin, Vermont Republicans. The opposition had been developing for months, based on protests of federal invasion of state's rights.

Vermonters told the subcommittee that a series of smaller dams would provide flood protection equal to that of the proposed West Dummerston dam, which, they insisted, would inundate century-old villages in the West River Valley. The entire project calls for 20 dams, of which 12 were to be in Vermont. Army men described the West Dummerston dam as the "key" dam.

•

Iowa Utility Makes Plans for New Substation

Plans are underway for construction of a new 33,000-volt substation at the Cedar Rapids power plant of the Iowa Electric Light & Power Co. Construction of the substation, which provides terminal facilities for six 33 kv. outgoing lines, was approved last month by WPB.

The new substation struction will be 108 ft. long, 36 ft. wide and 35 ft. high. Oil circuit breakers and switchgear together with grounding a transformer and Peterson coil, presently located in the nearby power plant, will be moved to the new substation. Oil circuit breakers for the 33 kv. lines will be arranged for remote control from the generating station as well as from the substation.

Foundation work on the substation started this week and steel work will begin about mid-June, it is estimated.

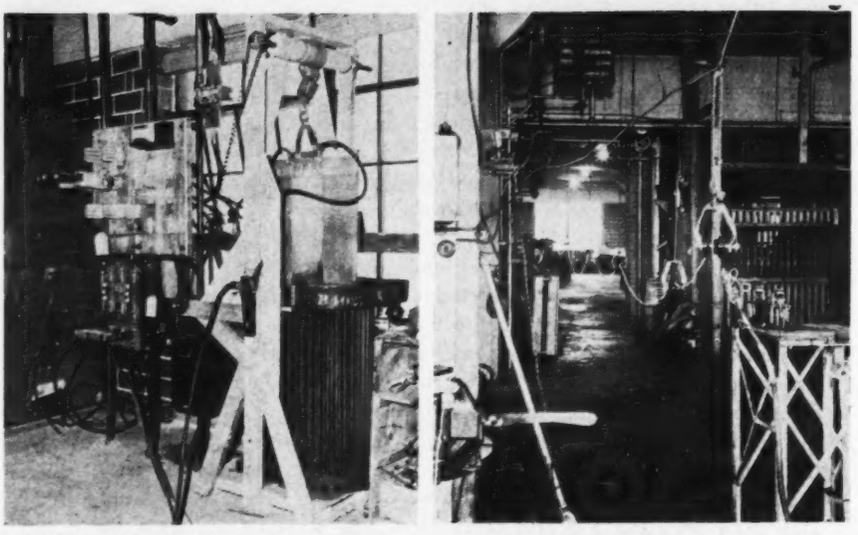
How

DESIGN · CONSTRUCT · OPERATE · MAINTAIN

How to Anneal Wire Electrically

All scrap wire, even down to lengths of 5 ft., is being electrically welded, electrically annealed and drawn to size in the warehouse of the Washington Water Power Co., Spokane, Wash., in this utility's salvage campaign to aid in the war effort. Before redrawing the wire, it is necessary that it be properly and uniformly annealed.

Former methods, none entirely satisfactory, have been displaced by passing an a.c. current of proper amperage through the wire as it hangs suspended in approximate 100-ft. lengths as shown. Current is controlled by the water rheostat and panel illustrated, all built up from obsolete and spare parts. Passage of about 800 amp. for around 30 sec. is required for 100 ft. of No. 6 copper wire. Voltage necessary for this amount of current and this length of wire is about 100 volts. Current values for this and other sizes of wire were determined by experiment. All work of this kind is done during spare time of the warehouse attendants.



WATER RHEOSTAT and control equipment (left) for supplying current for electrically annealing copper wire (right) preliminary to redrawing in utility warehouse. The device shown on the stand in the right foreground is a straightening machine consisting of several rollers which take the kink out of the wire preparatory to redrawing

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Conduit, Iron Wire Make a Heater

By E. J. KEOUGH
Supervising Electrical Engineer, Iowa Electric Light & Power Co.

Satisfactory heating of an 800-cu. ft. elevator penthouse exposed on all sides to Iowa winter weather, a locally-made electric space heater keeps elevator equipment working while the outside thermometer registers ten degrees below zero.

The heater (10 kw., 460 volt, 3 phase) has 1,000 ft. of spiral-wound 48-mil diameter iron wire stretched outside a three-in. conduit.

To make the spiral, the iron wire guided by a gloved hand was wound on a ¾-in. pipe while being turned at 400 r.p.m. by an electric drill. The ¾-in. pipe has an O.D. of 0.675 in.

$$0.675 \times 3.1416 = 2.12 \text{ in. circumference}$$

There are 20.8 turns per inch or 249.6 per foot.

Assuming the use of 20 ft. of pipe.

$$249.6 \times 20 = 4992 \text{ turns on 20 ft. of pipe}$$

$$499 \times 2.12 = 10{,}583 \text{ in. or } 881.92 \text{ ft. of wire.}$$

Therefore, the 20 ft. of pipe would accommodate approximately 900 ft. of wire.

Since the resistance increases greatly with the temperature rise, 460 volts was impressed across the wire and turns were cut out in steps until the center point was reached; here the current leveled off at 9 to 10 amp. The wire in previous tests was found to carry 10 amp. without approaching red heat; it was also found to have a resistance of 0.45 ohms for a 10 ft. section.

On a lathe using a gear ratio resulting in 2 threads per inch a spiral groove was cut on the outside of a

5-ft. length of 3-in. transit conduit. The 20 ft. of closely spiraled wire was fixed to a center terminal and stretched to the ends of the conduit where suitable terminals were provided.

The heater drew 9.2 kw. with three phases connected; 4.6 kw. with either outside leg disconnected, and 3.0 kw. with the center leg open. The change in the wire temperature while the center leg is open causes a lower resistance and, therefore, a proportionately higher current. This makes a very flexible heater with a large radiating surface. It is protected by 10-amp. fuses in the outside legs and a 20-amp. fuse in the center leg.

The remoteness of the penthouse, the existence of a three phase circuit in that area, and the government limitation on space heaters prompted this design which completed its second winter with no sign of deterioration.

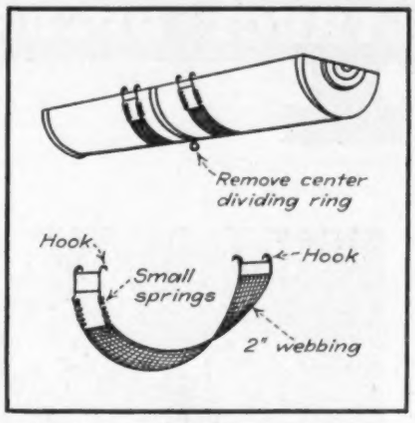
Spring Belts Speed F-Lamp Maintenance

By C. O. MARTIN
Hercules Powder Co., Radford, Va.

A commonly used kind of fluorescent lighting fixture is one in which the tubes are enclosed by curved glass, usually in two sections held at the ends in slots and in the center by a band or half-ring which is removed to disassemble the fixture for cleaning or replacement of tubes. Many fixtures of this kind are installed in the Radford Ordnance Works of the Hercules Powder Co.

Because the two sections of glass are released by removal of the center band, it required, previous to the development of the device here described two men working on one ladder to disassemble the fixture, one holding the sections while the other took off the band.

But two men are not needed now. One man does the job. He takes up the ladder with him a couple of webbing belts with hooked ends and including easy-tension springs as shown in the accompanying sketch. He hooks the belts to the top edges of the fixture in the manner shown and then removes the center band, the belts holding the glass sections in place. The sections are then taken out and cleaned one at a time.



BELTS permit fluorescent fixture to be disassembled by one man

Frequency Division By Multivibrators

By DONALD E. ANDERSON
Chief Engineer, J-B-T Instruments, Inc. New Haven, Conn.

An electronic tool which divides frequencies into sub-multiples of the original has been developed to provide a source of controlled frequency. It is called the Multivibrator and will divide a frequency into even or odd sub-multiples and still leave the resultant frequency under absolute control of the original source.

At J-B-T Instruments, Inc., standardization of oscillators at frequencies many times that of standard tuning fork electronic oscillation is possible by cutting down the frequency of the former until direct comparison may be made with the forks. This is accomplished by means of the multivibrator circuits shown in the accompanying diagram.

Each multivibrator section is essentially a two-stage resistance-coupled amplifier with capacitative coupling between the output and input points. With no external exciting voltage applied to the circuit, the multivibrator will oscillate at a frequency determined by the tube characteristics, plate voltage, and values of grid and plate resistors as well as of the coupling condensers. By correct choice of these components it is possible to "tune" these oscillations to any desired frequency.

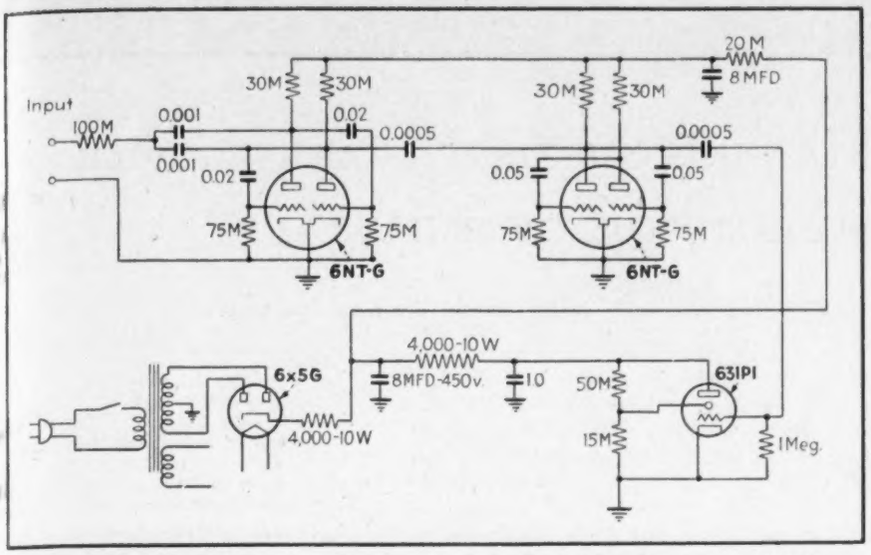
By proper coupling to an external source it is possible to control the frequency of the multivibrator at some fraction 1/n of the input frequency, where "n" is an integer. The integer "n" may be made an odd or an even value by the manner of connecting the input circuits or coupling between stages. The method shown in the illustration is one of many used —but all are similar in that to favor the even values of "n", the exciting voltage should be introduced in the same phase at the two tubes, and in opposite phase for odd values. It is also possible to obtain even or odd

Separate Switch for Each Transformer Phase

Each phase of the high voltage winding of a recently constructed British 30,000 kva., 110/34.6/7-kv. transformer has its individual 200 amp. switch. The reactances of the same transformer are between high voltage and low voltage windings 10½ percent, low voltage and middle voltage 17 percent, and middle voltage and low voltage 6 percent. These are two of the unusual features in a concentric coil three-winding transformer built by Metropolitan-Vickers Electrical Co., Ltd., and described in the *Electrical Review*.

The high voltage individual phase switch inside the tank is inclosed in an insulating barrier. Contacts are within a bakelite cylinder which is supported at the top and bottom. Each insolating switch, suitable for operation only when transformer is off the circuit, is actuated by a shaft, which passes through the oil-tight packing glands mounted on the cover, operated by a hand-wheel on the top of the tank.

High reactances are obtained by placing the coils concentric, the high voltage on the outside, middle voltage on the inside next to the core, and the low voltage winding between the two coils carrying higher voltages. The high voltage bushings are standard "Metrovick" outdoor condenser type, mounted on cylindrical housings bolted to the tank cover. The outside surface of that portion of the bushing within the housing consists of a grounding strip or band, making the housing a suitable place for mounting a bushing current transformer.



SCHEMATIC DIAGRAM of a multivibrator. Two 6N7-G (6NT-G above) multivibrator stages divide input frequency of 400 cycles by four to permit 631-P1 Strobotron to flash at 100 cycles; operates throughout range from 350 to 450 cycles

divisions by exciting only one tube.

The diagram illustrates two multivibrator stages using 6N7-G tubes, each dividing by two. With a 400-cycle input, 100 cycles is obtained under absolute control of the input, and used to control the 631-P1 Strobotron. Complete control with division by four is easily obtained with a variation of input frequency from 350 to 450 cycles. A simple 6X5-G rectifier furnishes plate voltage. Complete use of this device for calibration of frequency meters will be described in a future issue of ELECTRICAL WORLD.

Instead of controlling light pulses from the Strobotron, the multivibrator output could be filtered if desired, fed into an amplifier, and used to actuate a frequency meter, other measter output could be filtered if desired, designed for 100 cycles from the 400 cycle frequency available. By changing the value of the grid-plate coupling condensers (0.02 and 0.05) other frequency ratios may be accommodated.

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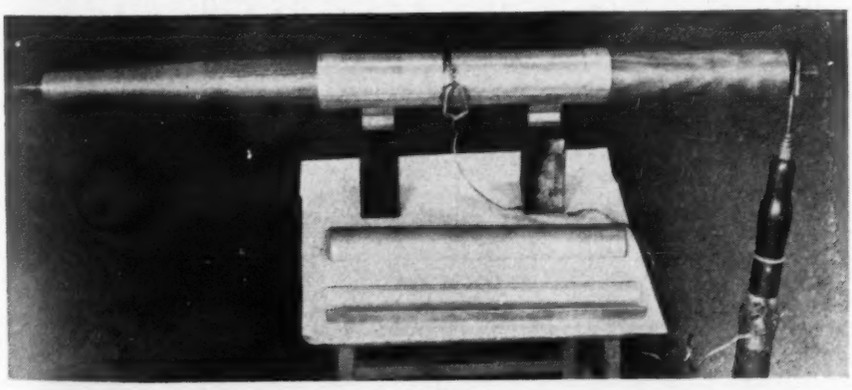
Sleeves Replace Braid in Insulation P. F. Test

By T. W. BUTTNER
Equipment Engineer, Columbus & Southern Ohio Electric Co., Columbus, Ohio

A split metallic sleeve, conforming precisely to surface dimensions of bushing stem insulation, is used in preference to a copper braid or tinfoil surface electrode in making Doble field power factor tests of bushing stem insulation by the Columbus & Southern Ohio Electric Co.

It has been found that when using a conventional braid electrode to secure intimate surface contact with the insulation, sufficient variation in contact area between the tape and "cellulac" insulation exists to make duplicate readings difficult to obtain. The split sleeve type of electrode corrects this condition and makes it possible to secure duplicate readings on the same bushing stem even after the sleeves have been removed and reinstalled—a situation virtually impossible with metal tapes.



SPLIT METAL SLEEVES squeezed over bushing-stem insulation in Doble power factor tests yield more accurate data on repetitive tests

Sleeves used at Columbus are of zinc, and were built up by spraying metal $\frac{1}{4}$ in. thick on a machined-steel arbor ground to conform to the exact diameter of the bushing stem. The resulting tube of standard 18-in. length is removed from the arbor by slitting it down both sides with a lathe tool.

This method yields a sleeve that is entirely free from internal stresses. Presence of even a small air space between the sleeve and its encased insulation detracts from the accuracy of measurement.

Arbor Preparation

Preparation of the arbor on which the sleeve is built up is critical and in general the direct opposite of the procedure to be followed in making a permanent metal spray shaft repair. The arbor is first machined and ground smooth and to exact dimensions. Surface grease or dirt is removed from the arbor by flowing carbon tetrachloride over the surface. Caution should be observed not to touch the arbor or rub it with cloth or rags during washing or before spraying.

Metal spray is applied in the usual manner with the spray gun mounted in the tool clamp of a lathe. While zinc was used for the sleeves any metal; preferably easily machined will serve equally as well. Thickness of the spray metal should be suitable for mechanical stiffness. The sleeve length is fixed by the specifications for the Double test in 18 in. It is well, however, to build out enough length on the arbor to allow sleeve ends to be rounded off for a corona shield.

Three sets of split sleeves conforming to the dimensions of standard bushing stems used on the system are used by the Columbus company. During the test they are squeezed over the bushing stems as shown.

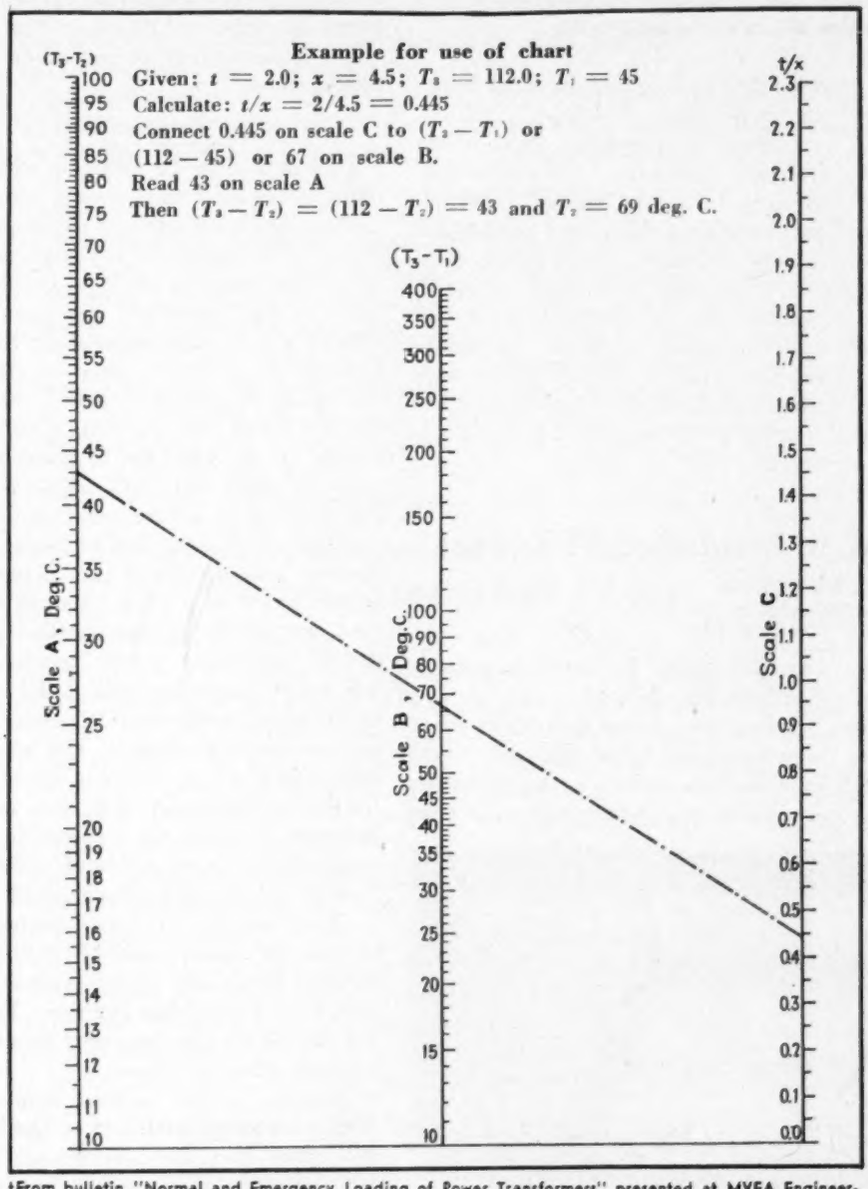
Accuracy of the internal diameter of the sleeves is illustrated by the fact that when they are placed over the bushing stem and squeezed firmly a noticeable vacuum holds them in place, showing that air has been displaced between the stem and sleeve.

CHART FOR OBTAINING OIL RISE IN TRANSFORMER FOR SHORT-TIME OVERLOADS

By H. B. KEATH and W. L. J. F. GODIN† Wagner Electric Corporation, St. Louis

This chart was constructed to yield values of oil rise for short-time overload periods lasting *more* than ¼ hour. Values of T_3 corresponding to various loads in percent of nameplate rating for self-cooled transformers with copper to core loss ratios of 2:1 and 2.5:1 are given in the accompanying table.

The oil rise for overload of *less* than ¼ hour is generally negligible. But there may be cases when exceptionally heavy load occurs, duration of which is less than 15 minutes. For this case a very simple expression, of which an example is shown below, has been developed to determine the short-time oil rise.


Example for use of chart
Given: t = 2.0; x = 4.5; T3 = 112.0; T1 = 45
Calculate: t/x = 2/4.5 = 0.445
Connect 0.445 on scale C to (T3 − T1) or
(112 − 45) or 67 on scale B.
Read 43 on scale A
Then (T3 − T2) = (112 − T2) = 43 and T2 = 69 deg. C.
(T3-T2)
(T3-T1)
t/x
Scale A, Deg.C.
Scale B, Deg.C.
Scale C

†From bulletin "Normal and Emergency Loading of Power Transformers" presented at MVEA Engineering Conference. See also issues of Electrical World, March 18, 1944, page 116; April 15, 1944, page 118; and May 13, 1944, page 122.

$T_2 = T_3 - (T_3 - T_1)\,(1 - 0.005\,t)$ in which

T_2 = oil rise in t minutes

T_3 = alternate oil rise if the load is carried indefinitely (see table and also chart in ELECTRICAL WORLD April 15, 1944, page 118)

T_1 = starting oil temperature

Basic formula for the chart is:

$$T_2 = T_3 - \frac{T_3 - T_1}{P}$$

in which the following are known

T_1 = Initial oil gradient (rise of oil above ambient at start of overload)

T_2 = Oil gradient after t hours

T_3 = Oil gradient which would result load were carried continuously

$P = e^{t/x}$

Also

t = time in hours

x = time constant in hours

$$= \frac{T_3}{W} \bullet \frac{3.5\,(\text{Cu} + \text{Fe} + 2/3\,\text{Tank}) + 83G}{60}$$

where

T_3 = Final oil temperature rise in degrees C caused by the total losses, of which the initial loss is W in watts (for nameplate rating)

G = Gallons of oil. NOTE: If Noflamol (Askarel) is used, take 87G

Fe = Weight of core iron in pounds

Cu = Weight of the copper in pounds

Maximum Oil Rise

n	θ_3 deg. C.	T_3			
		m = 2 to 1		m = 3.5 to 1	
		55 deg. C. Trans.	40 deg. C. Trans.	55 deg. C. Trans.	40 deg. C. Trans.
0	0	18.7	12.45	13.5	9.0
10	.50	19.0	12.65	14.3	9.5
20	1.52	19.9	13.28	15.0	10.0
30	2.92	21.3	14.20	16.9	11.3
40	4.62	23.3	15.52	19.3	12.9
50	6.60	25.8	17.20	22.4	14.9
60	8.83	28.8	19.20	25.8	17.2
70	11.3	32.3	21.5	30.0	20.0
80	14.0	36.1	24.1	34.6	23.1
90	16.9	40.4	26.9	39.6	26.4
100	20.0	45.0	30.0	45.0	30.0
110	23.1	50.0	33.3	51.2	34.1
120	26.8	55.3	36.8	56.9	37.9
130	30.4	60.9	40.5	63.7	42.5
140	34.3	66.8	44.5	70.5	47.0
150	38.3	73.1	48.8	77.5	51.6
160	42.4	79.6	53.1	84.6	56.3
170	46.7	86.4	57.6	92.5	61.6
180	51.2	93.4	62.2	100.8	67.0
190	55.9	100.8	67.2	109.0	72.7
200	60.6	108.6	72.2	117.5	78.3
210	65.6	116.2	77.2	127.0	84.5
220	70.8	124.3	82.8	136.2	91.0
230	75.8	132.6	88.2	148.0	98.5
240	81.2	141.1	93.8	156.0	104.0
250	86.6	149.9	100.0	165.0	110.0
260	92.3	158.9	106.0	175.6	117.0
270	98.0	168.1	112.0	186.0	124.0
280	103.9	177.5	118.4	197.0	131.0
290	109.9	187.1	125.0	208.0	138.5
300	116.0	197.0	131.0	219.0	146.0

Rolled metal edge makes cutout strong, easy to install.
Oxidized-copper dielectric element gives excellent uniformity of operation.
Stiff fiber insulation makes cutout mechanically sturdy. Also excludes moisture.

For low-cost, dependable FILM CUTOUTS

for your series-lighting sockets specify "G-E Novalux"

They're DESIGNED to

- *Reduce servicing time*
- *Prevent "duds" due to handling*
- *Minimize unscheduled "blackouts"*

Small as they are, cutouts can make a big difference in the continuity and the service costs of your series lighting.

G-E Novalux copper-oxide film cutouts are built to unusually high uniformity, mechanically and dielectrically. They are not affected by heat, dampness, or pressure. The oxidized-copper dielectric element is enclosed in a moisture-proof aluminum and fiber casing which resists damage and will not come apart.

Of course, G-E Novalux cutouts are standard equipment for G-E Novalux series sockets—but regardless of what makes of sockets are installed in your system, you can use Novalux film cutouts as replacements.

For further information, write or phone the nearest G-E office. *General Electric Company, Schenectady 5, N.Y.*

These sturdy, high-quality series sockets will save time and money on maintenance, and will prevent many service outages. They withstand temperature changes, vibration, and atmospheric corrosion that have often caused street lighting sockets to fail. They are standard equipment for G-E Novalux luminaires—but they can also be used as replacements in any series luminaires you are using.

Novalux Renewal Parts catalog—complete, well illustrated—facilitates checking stock and ordering parts. Write for a copy of GEA-4084.

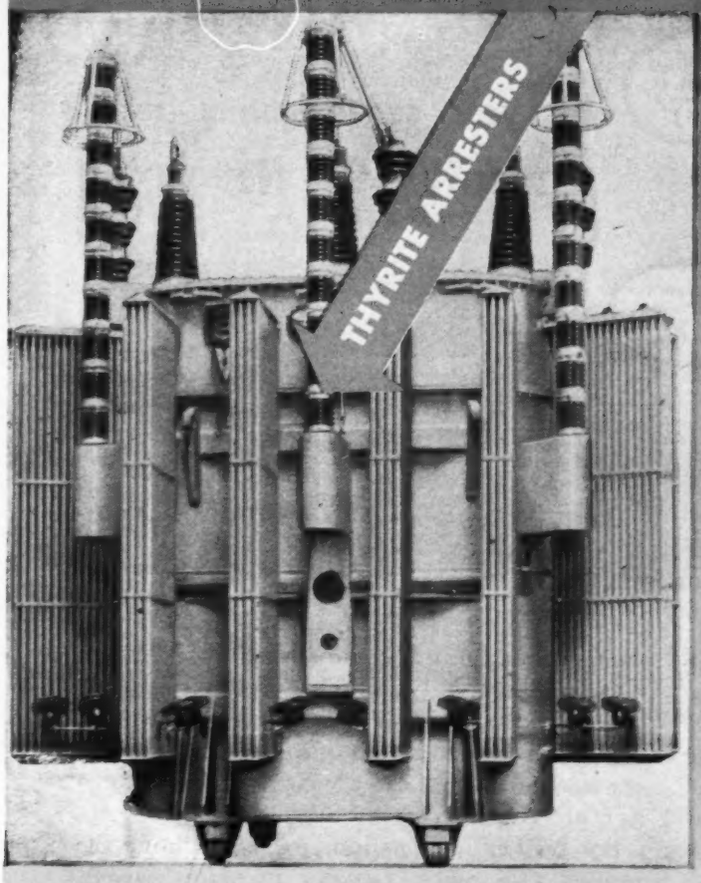
Buy all the BONDS you can
—and keep all you buy

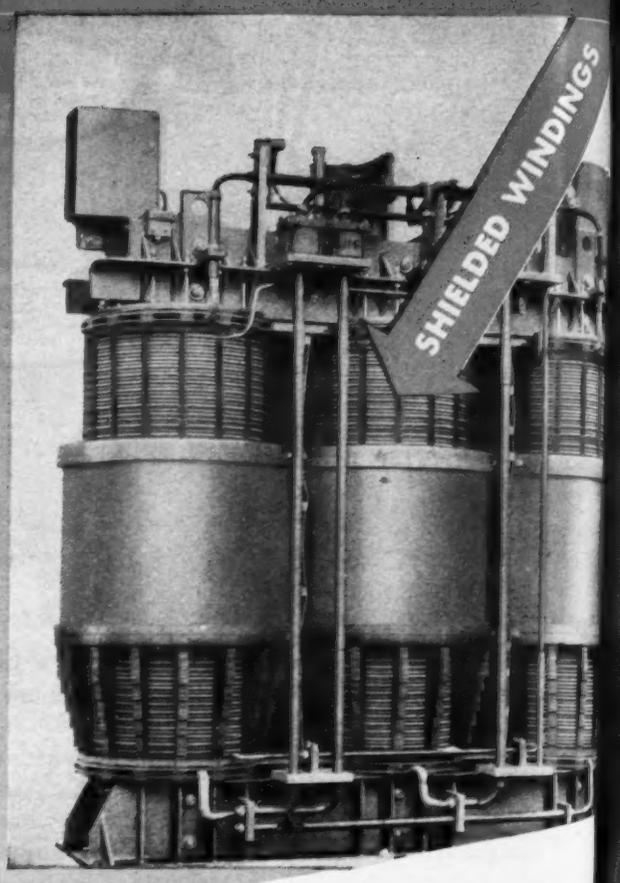
Novalux
RENEWAL PARTS
for Luminaires

GENERAL ELECTRIC

452-2a-3010

Co-ordinated for protection



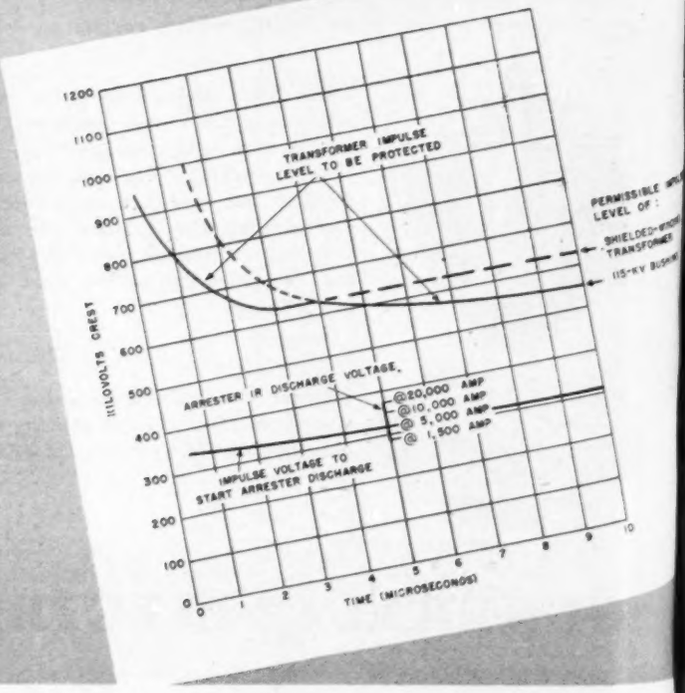


THYRITE* LIGHTNING ARRESTERS reduce lightning impulses and voltage surges to values safely below the impulse-test level of the transformer. Note how they can be mounted on the transformer—co-ordination in appearance as well as function

SHIELDS around the high-voltage winding of the transformer are connected to the line terminal. These shields properly distribute voltage impulses and surges throughout the winding, keeping internal stresses to values well within the strength of the insulation. G-E power transformers 44 kv and higher have shielded windings.

CO-ORDINATED PROTECTION CURVES show the impulse protection level of Thyrite station-type arresters compared with the transformer impulse level to be protected. These curves apply to a 115-kv shielded winding transformer protected by a Thyrite arrester for a 115-kv grounded-neutral system. This arrester will withstand lightning discharge currents as high as 100,000 amperes, and still hold the lightning voltage below the impulse-test level of the transformer.

*Reg. U.S. Pat. Off.



—that takes the destructive power out of lightning impulses and switching surges

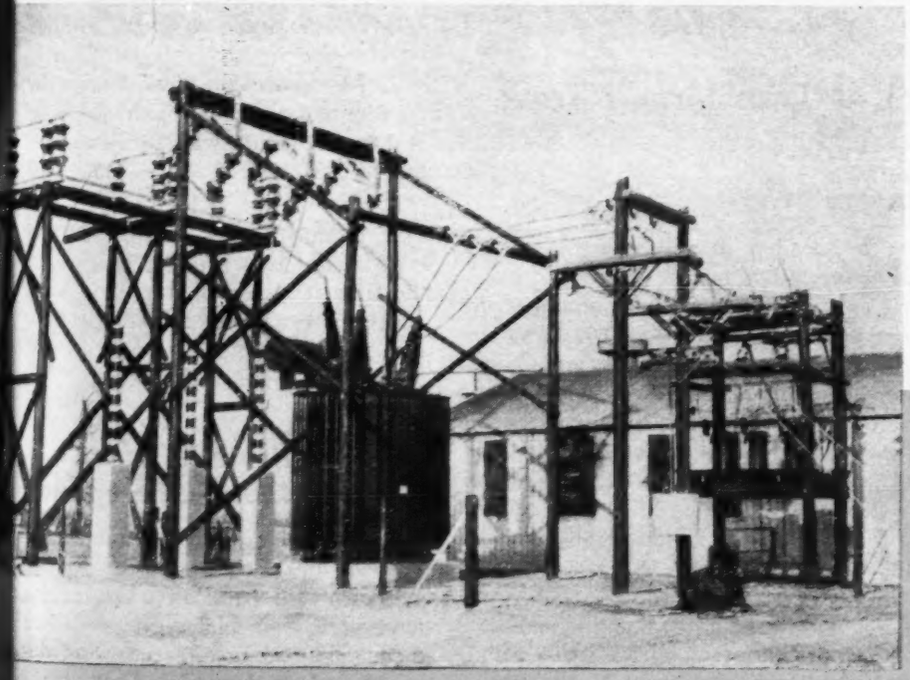
"CO-ORDINATED FOR PROTECTION" means that the arrester limits the lightning or switching-surge voltage which can reach the transformer, and the shielding distributes the voltage harmlessly throughout the winding.

1. Thyrite station-type lightning arresters limit impulse voltages to demonstrably low values—predetermined over a wide range of wave fronts and discharge-current magnitudes.

2. The shielding in G-E power transformers, by distributing throughout the winding the voltages allowed by the arrester, prevents abnormal concentration of stress regardless of the wave shape or frequency of the incoming surge.

FOR DEPENDABLE PROTECTION use *both* of these modern means of preventing damage to power transformers. More than 2600 G-E shielded-winding transformers — totaling more than 24,000,000 kva—are now serving the nation, helping to insure uninterrupted production. Many thousands of Thyrite arresters, installed on circuits from 2.3 kv to 287 kv, are providing unexcelled protection —preserving transformers and other vital electric equipment that is delivering indispensable power.

FOR FURTHER INFORMATION on G-E shielded-winding transformers, ask for Bulletin GEA-2305; on Thyrite lightning arresters, GEA-1304. *General Electric Company, Schenectady 5, N. Y.*



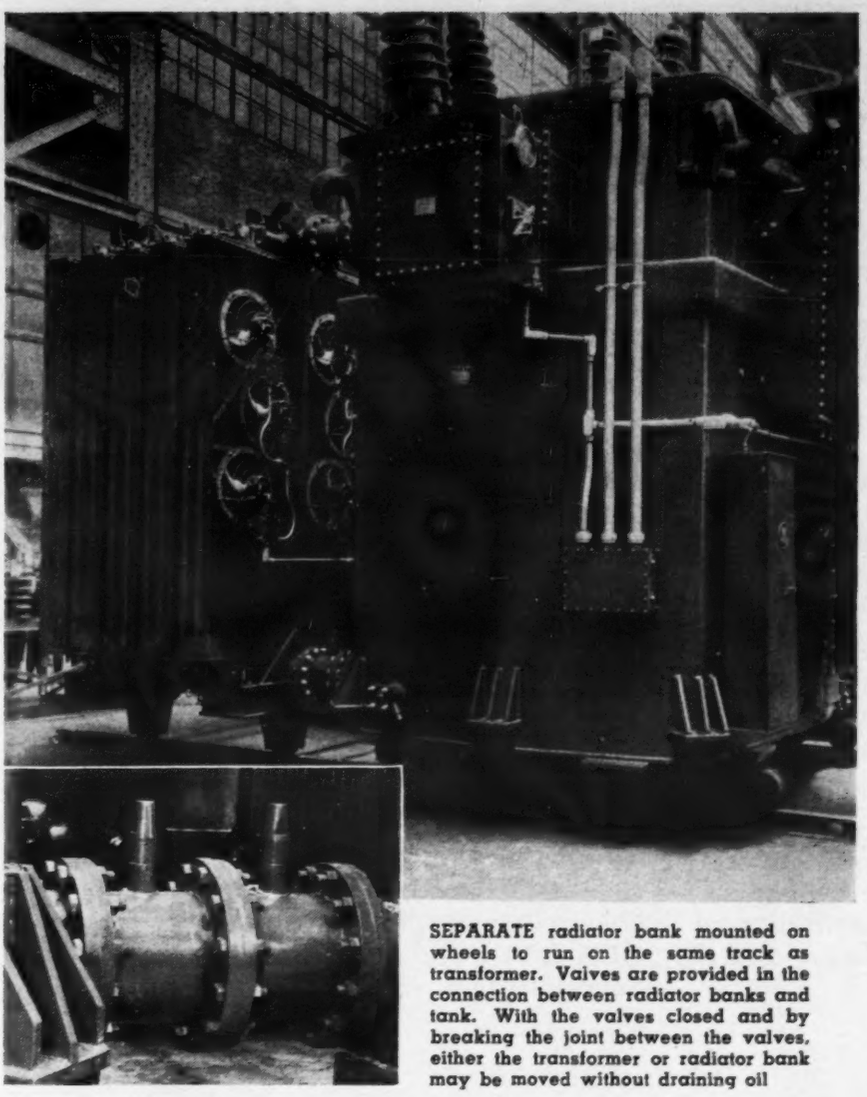
POWER TRANSFORMERS
AND
LIGHTNING ARRESTERS

← PROTECTION on the "Big Inch"—Shielded windings and station-type, Thyrite lightning arresters are doing their part to prevent station outages on this famous pipe line. It's a responsible job, when you consider that just one station outage would reduce the output of the entire pipe line by 35 per cent.

GENERAL ELECTRIC

401-16-5185, 5000

Every week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds.



SEPARATE radiator bank mounted on wheels to run on the same track as transformer. Valves are provided in the connection between radiator banks and tank. With the valves closed and by breaking the joint between the valves, either the transformer or radiator bank may be moved without draining oil

Radiator Independent of Transformer Tank

By R. L. BROWN
Transformer Engineer, Westinghouse Electric & Manufacturing Co., Sharon, Pa.

Until recently radiators for transformer cooling have been attached to the transformer tank wall. For large units this usually requires that all the tank walls be used for radiators, which often does not leave sufficient room for other fittings such as tap changer hand wheels, terminal chambers, instruction plates, and lightning arrester brackets.

A simple solution to this problem has been found. The necessary number of radiators required to cool the transformer are mounted in an assembly on its own base, independent of the transformer tank. The inlet and outlet connections from each radiator are connected to header pipes which are in turn arranged so they can be connected to the transformer tank. Valves are provided in the headers as well as in the flanged connections to the tank.

The base for the radiator bank may be equipped with wheels to run on the same track as the main transformer or pads on each corner of the base may be used. In either case the wheels or pads are made so that the radiator assembly may be raised or lowered to line up the header connections on the radiator assembly with flanged openings in the transformer tank.

This system of mounting radiators separately accomplishes many results which are of interest to the station designer and operator.

1. It is usually possible to ship the radiator bank completely assembled, thus eliminating field assembly.

2. The radiator bank may be located on any side of the transformer.

3. The header connections may be made long enough to locate the radiator bank on the outside of a building with the transformer inside or on the opposite side of a wall from the transformer.

4. It is possible to clean and paint the radiators without taking the transformer out of service.

5. Provision can be made for fans to increase the rating by as much as one third.

It is easy also to arrange for the addition of oil circulating pumps in the header connections to get a further increase in rating up to two thirds of the self-cooled rating.

The fans and pumps can be automatically controlled so that when the winding temperature reaches a predetermined temperature the fans will start and if the load increases further the pumps will start. The pumps do not interfere with the self-cooled or air-blast ratings when they are shut down. This saves the power required to run the pumps and fans when they are not required and saves wear and maintenance on the fan and pump motors.

6. The space made available on the tank walls may be used for fittings such as terminal chambers, tap changer handwheels, instruction plates, valves, control cabinets, lightning arresters, and so forth, without interference from the radiators.

7. To repair the transformer it may be moved to the repair house or sent to the factory without disturbing the radiators. This saves time and expense.

It is thus unnecessary to buy a transformer larger than required at the time it is purchased. It is only necessary to provide for adding fans and pumps to take care of future increases in power requirements.

Notation System For Meter Nameplates

The notation scheme, here described, has been adopted by the Wisconsin Electric Power Co. for the aluminum nameplates of watthour meters, indicating and recording demand meters, thermal indicating demand meters, time switches and the like. This method of designating meters appeared in the metermen's handbook published in 1912, but now out of print. The notation permits

identification of the meters as to: (1) make and manufacturer's type designation; (2) company serial number; (3) ampere rating; (4) voltage rating and (5) dial constant.

To illustrate the application of this notation, consider a specific watthour meter having a designation—B-1000-5-1-D1 or B-1000-R5-1-D1. The interpretation is as follows:

The first letter, or letters, indicates the manufacturer's type of meter. In this case "B" denotes a G.E., I-14, 16, 20, 60-cycle, single-phase meter; "A" would denote a Westinghouse OA, 60-cycle single-phase meter; "V" a Sangamo H or HC, 60-cycle, single-phase meter and so on through the entire list of meters used in Milwaukee, each is letter designated. If an asterisk (*) is used after the first letter in the meter designation it denotes a detachable type meter.

The first figure, "1000" in the example, is the company serial number of the particular type meter. The letter "R" following the serial number indicates a reactive meter.

The second figure indicates the ampere rating of the watthour meter.

The third figure indicates the voltage of the meter as shown in the following table.

1. Nominal 120 volt—2 wire- 1 phase, 3 phase and D. C. meters.
2. Nominal 240 volt—2 wire-1 phase, D. C. meters.
   Nominal 240 volt—3 wire-3 phase
3. Nominal 240 volt—3 wire-1 phase, D. C. meters.
4. Nominal 480 volt—3 wire-3 phase
5. Nominal 600 volt—2 wire, D. C. meters.

The letter "D" followed by the number designates the dial constant of the meter "D1". A red letter "k" if used on a dial face indicates a constant other than 1. Such a constant is shown on the dial face.

• • •

Special Mountings for Power Banks

In a growing number of instances recently the Detroit Edison Company has resorted to individual poles, rather than a platform, to support the transformers of a power bank. This practice, which has evolved during the war period, came about through the scarcity of steel, the expense of platform construction and some dissatisfaction with the awkwardness of platforms in mounting and removing transformers.

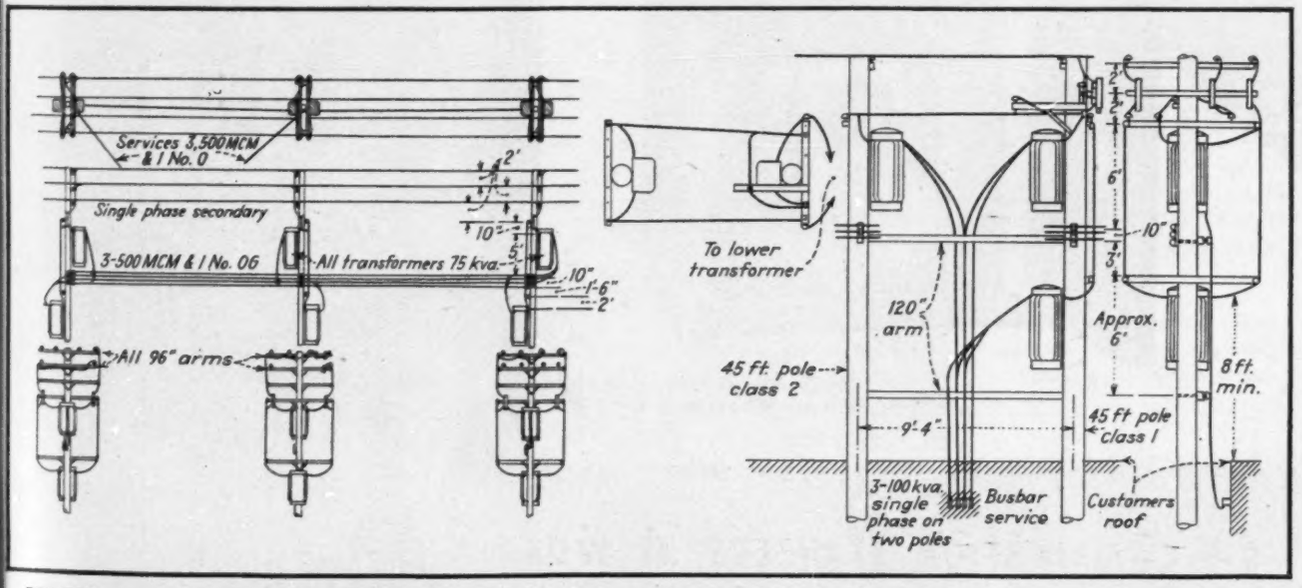
Two special variations of the "individual pole" method of mounting transformer banks are illustrated. Both installations were made on a trial basis to supply industrial establishments in the Detroit area. Neither type of installation is in general use, each having been developed to meet special situations. To date, however, experience with these installations has been favorable.

Six transformers, three poles—Temporary service to a war load in an industrial-residential area where a business frontage backed up on a residential area required a transformer capacity of 450 kva. Normally three 150-kva. units would have been used, but none were in stock. Six 75-kva. transformers were substituted. These were arranged, as shown, in a closed delta bank on existing poles of a 4,800-volt primary line running down the alley that separates the residential from the industrial property.

The heavy transformers are put on opposite sides of the pole to eliminate eccentric loading and to facilitate changing of transformers by maintenance crews. Sufficient vertical separation is provided between transformers to conform to rules for climbing space.

Two platforms supported from three poles would have been required to support the six transformers in the conventional manner. Presence of garages on the alley in each 30-foot residential lot interfered with this arrangement. Two of the 75-kva. units were mounted on each of three of the existing primary line poles. Interference with the garages was avoided and a substantial saving in cost was effected in a temporary installation.

Three transformers, two poles—Where available space was too restricted for either standard platform or individual pole mounting, transformers of 300-kva. closed delta bank were grouped on facing poles only 9 ft. 4 in. apart, as shown in the sketch. Service conductors were trained downward on insulators fastened to spacer members between poles. Entrance to the building was through a busbar service entrance.

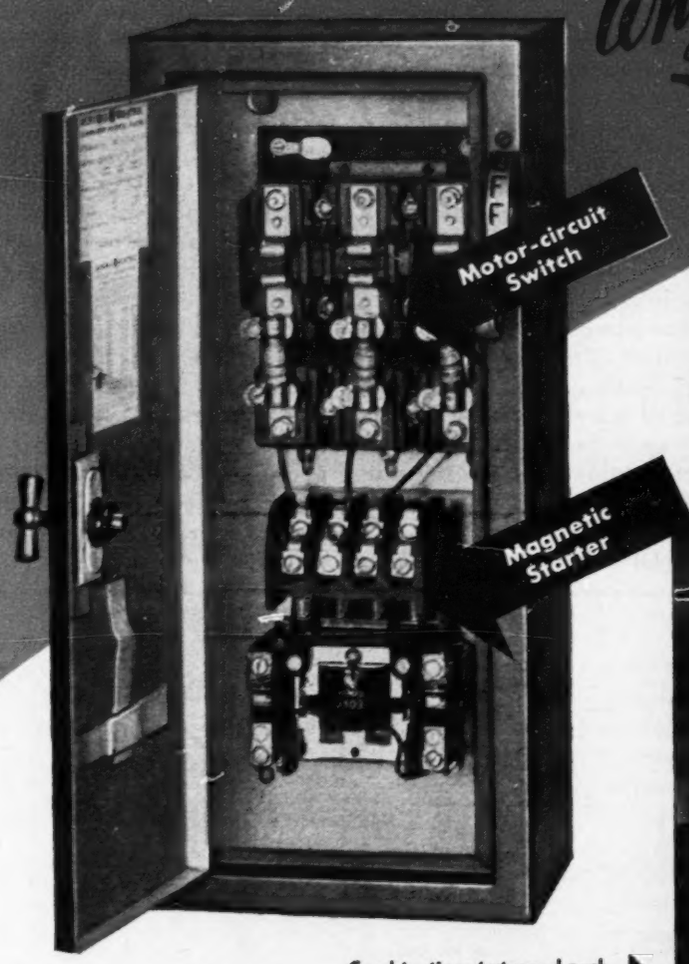


SIX 75-kva. units of 450-kva. power bank mounted at normal spaces overcome platform interference with alley garages. Three 100-kva. transformers on facing poles; no space for platform or individual pole mounting.

You can save time and space

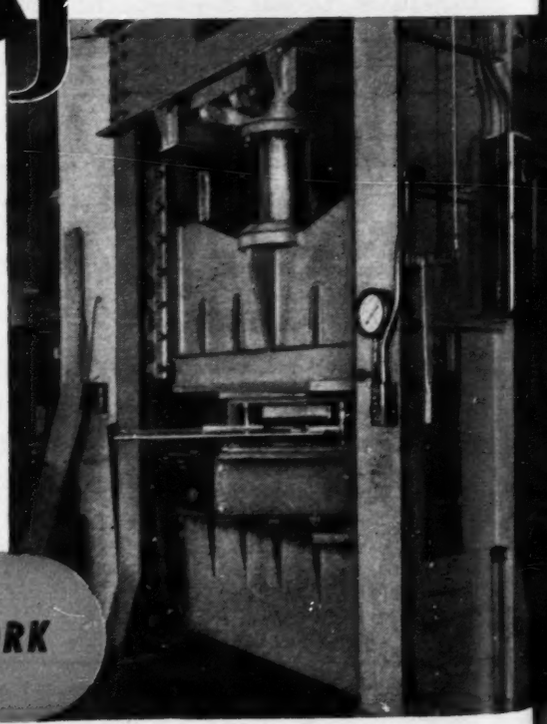
ONE COMPACT

Why two devices? ONE



COMBINATION STARTER

Combination starter and push-button station on a press



G-E COMBINATION STARTERS AT WORK

gain greater protection too

UNIT

can do the job.

FOR MOTOR CONTROL AND PROTECTION

YOU no longer need buy a separate device for each function of motor control. Now you can get *combination* control—in a *variety of enclosures* to meet every operating condition. This control combines a motor-circuit switch and a magnetic starter in one, compact, easy-to-mount unit.

By using these starters you profit five ways:

1. Quick Selection—By ordering *one* factory co-ordinated unit instead of two, you can save time. You just specify the motor rating and indicate the type of motor-circuit switch you want and the type of application you have in mind—we'll send you the starter you need.

2. Reduced Installation Time—Users of combination starters report a 50 per-cent reduction in mounting time and a 40 per-cent reduction in wiring time.

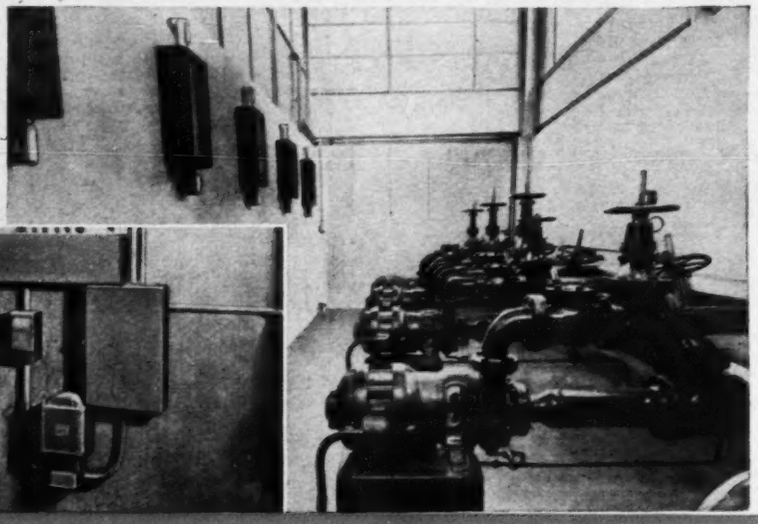
3. Motor Protection—With G-E combination starters, you're sure that the rating of the motor-circuit switch or breaker matches that of the magnetic starter with which it is to be used. The co-ordination of thermal overload relays with the fuses or breakers affords complete motor overcurrent protection under any condition of operation.

4. Greater Safety—The motor-circuit switch, being in the same case with the magnetic starter, is mechanically interlocked with the cover. Thus the cover cannot be opened while there is power on the starter.

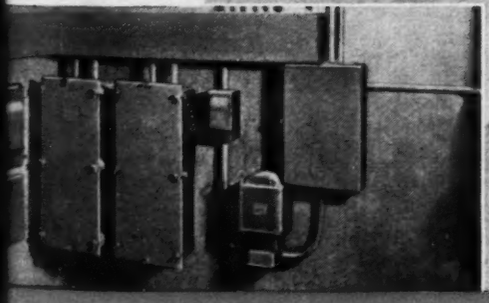
5. Less Space Required—Combination starters take less mounting space than separately mounted safety switches and starters.

These starters are also available for high-voltage starting. For further information on combination starters write to your local office for Bulletin GEA-3715. *General Electric Company, Schenectady 5, New York.*

Combination starters (on wall at left) installed in a pump room



For reliability of operation, combination starters with dust-tight enclosures in a grain elevator



Every week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds

GENERAL ELECTRIC

69 kv 0.003 muf | 115 kv 0.002 muf | 138 kv 0.0015 muf | 161 kv 0.0012 muf | 230 kv 0.001 muf | 287 kv 0.00075 muf

This "family" of standardized G-E Type CW carrier-current coupling capacitors and Type KA potential devices permits assemblies of any established voltage ratings.

GENERAL ELECTRIC

Coupling for better CURRENT SERVICE

COUPLING capacitors are the bridge between carrier equipment and the power line. They couple two fields of engineering — electric power and electronics. Joint use of lines for carrier current and power requires coupling capacitor units capable of withstanding the highest transmission line voltages and of passing the lowest carrier-frequency voltage.

G-E engineers have pioneered almost every outstanding achievement in carrier-current development. In G-E Type CW coupling capacitors they have developed coupling of extraordinary structural and electrical dependability. This coupling faithfully passes one or more carrier frequencies — regardless of lightning, line-switching surges, rain, snow and sleet. It also has permitted many existing carrier-current installations to take on extra-heavy war duties. When combined with G-E potential devices, this coupling greatly reduces the size, weight and cost of critical materials necessary to provide potential for synchronizing, relaying, and similar services.

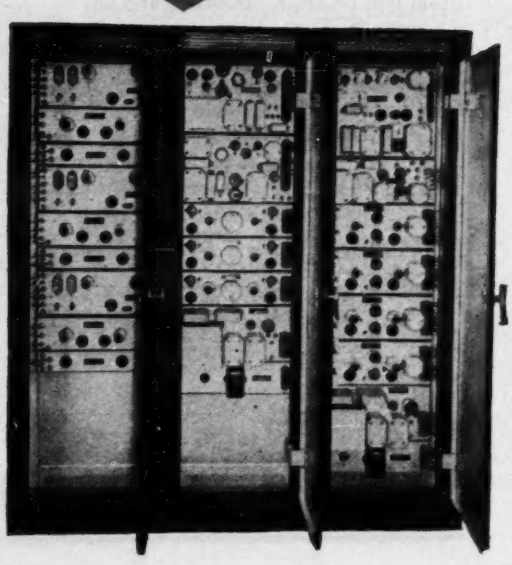
In the past ten years, more than 8000 G-E CW capacitor units have been applied to new carrier-current installations, and modernization of old ones—*without a single electrical failure.*

General Electric engineers are prepared to discuss — *now* — the carrier-current services and equipment which may be advantageously applied to your particular light-and-power system — either toward immediate operating improvements or as a part of your expansion program. *General Electric, Schenectady, N. Y.*

* *Tune in "The World Today" every evening except Sunday at 6:45 E.W.T. over CBS. On Sunday listen to the G-E "All Girl Orchestra" at 10 P. M. E.W.T. over NBC.*

ANY COMBINATION OF CARRIER-CURRENT SERVICES YOU NEED

may be made from 77 different G-E standard "Panel Units"—housed in standard cabinets of convenient size for indoor or outdoor installation. Major carrier functions include: *Pilot Relaying. Transferred Tripping. Signaling. Telephony. Telemetering. Supervisory Control. Automatic Load Control. Line Sectionalising Control.*



GENERAL ELECTRIC HAS PLANNED AND BUILT MORE CARRIER-CURRENT EQUIPMENT THAN ALL OTHER MANUFACTURERS COMBINED

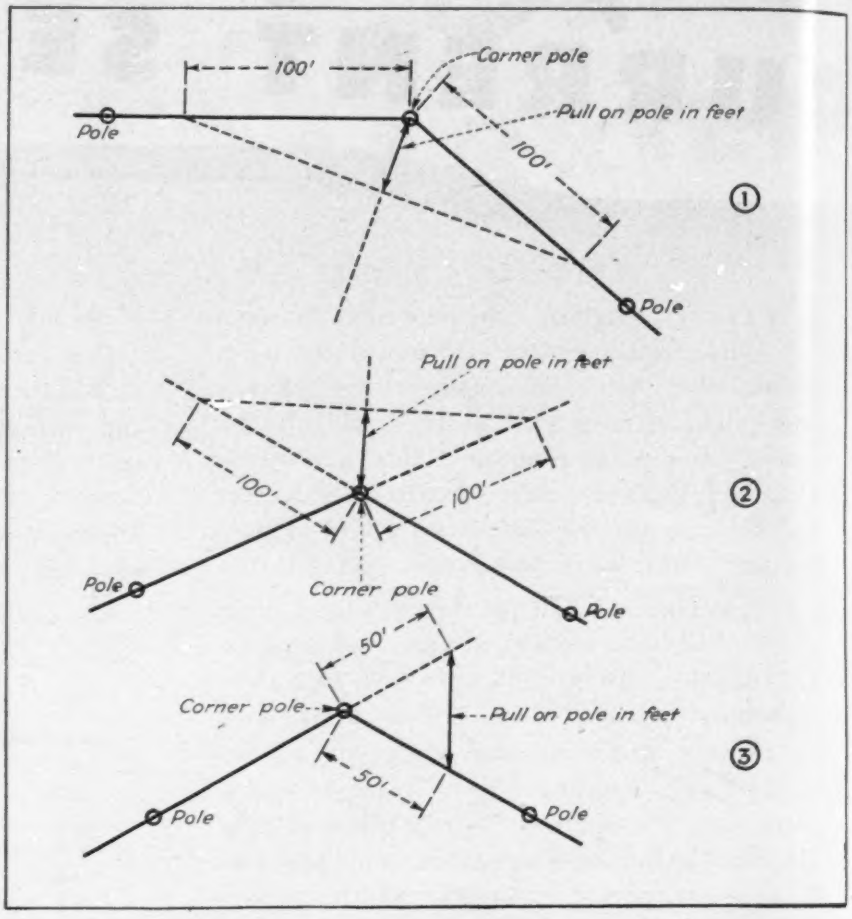
GE

CARRIER CURRENT

THE NERVE NETWORK OF THE POWER SYSTEM

PULL MEASUREMENT ON CORNER POLES

Methods for determining the amount of pull on corner poles, also angle construction for single and double crossarms are adapted from standards of the Hartford (Conn.) Electric Light Co.



Pull Measurements

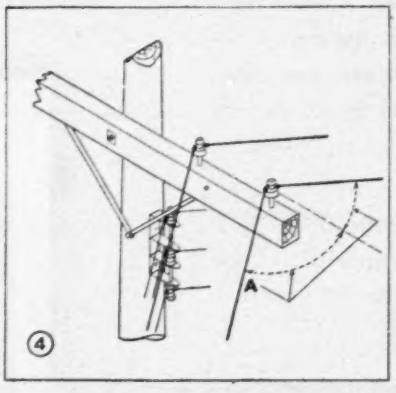
Size of angle due to the change in direction of the line may be measured by the pull as shown in the sketches. The pull is defined as the distance measured along the line splitting the line angle into two equal parts between the corner pole and a line sighted between two points on the line 100 ft. from the corner pole; see Fig. 1.

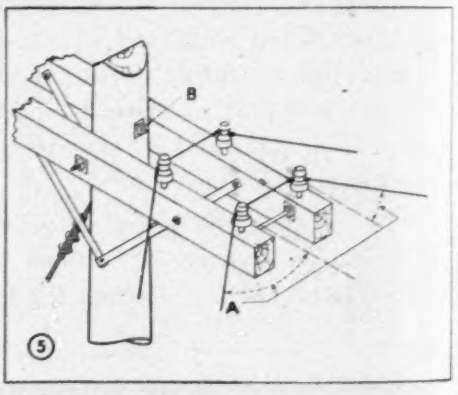
Where that method cannot be used because of obstructions, methods shown in Figs. 2 or 3 may be used.

Angle Construction

With Single Crossarm—Install crossarm so as to split angle of turn, A in Fig. 4. Refer to table for angle pull. On angle poles tie wires on side of insulator so that strain will be against insulator and not on the wire.

With Double Crossarms—Use double crossarms for crossings and dead ends. Install arms to split angle of line, A in Fig. 5. Refer to table for angle pull. If the unbalanced load exceeds 4,500 lb. use a through-bolt at B to prevent splitting.





Angle Pull for Type of Construction and Wire Size*

Type of Construction, Pins	Wire Size, No.	Angle Pull, feet Angle Construction	
		Single Crossarm	Double Crossarm
Wooden	4 and smaller	0–26	0–50
	2	0–17	0–33
	1/0	0–12	0–26
Steel Pins	4 and smaller	27–50	0–50
	2	18–33	34–50
	1/0	13–23	26–47

* Table is based on 500 lb. for wooden pins and 1000 lb. for steel pins.

AT 150°C

THE G-E INSULATING VARNISH WAS UNCRACKED

Rigid tests of each new varnish developed by General Electric is a prime prerequisite to placing it on the market. And, naturally, these tests are made under conditions duplicating, in a more exacting degree, those which the varnish is compounded to meet. Typical was the test of two varnishes, each intended for insulating electrical apparatus where high temperatures would be encountered. The G-E varnish withstood the accelerated heat-aging test; the other broke down.

If you face a problem in finding the correct insulating varnish for your specific needs, the engineering staff of the Resin and Insulation Materials Division of the General Electric Company will gladly co-operate with you. Consult your local G-E Distributor or write to: Section M642-9, General Electric Company, Schenectady 5, New York. (Varnishes are one product in the complete line of G-E insulation materials.)

THERE IS A G-E INSULATING VARNISH FOR EVERY NEED

★

Hear the General Electric radio programs: "The G-E All Girl Orchestra" Sunday 10 p.m., EWT, NBC. "The World Today" news every weekday 6:45 p.m., EWT, CBS.

BUY WAR BONDS

GENERAL ELECTRIC

Electronic Detector For "Holidays"

A device to locate rapidly skips or breaks, called "holidays," in the protective coating of pipe against corrosion and deterioration, has been developed by Mr. D. E. Stearns of the United Gas Pipe Line Co. It is called the Electronic Holiday Detector. This unit is an electronic device using an automotive type battery to energize a high voltage surge generator to supply the test impulses.

In operation the carriage rolls along the top of the pipe causing the exploring electrode, a coiled spring wrapped around the specimen, to roll over the surface of the pipe, thus assuring complete exploration of the area being inspected.

The rollers under the carriage are of soft rubber, each roller supporting 30 lbs. The high voltage lead to the exploring coil is only 16 in. long, too short to introduce variable losses. The instrument case, the electrode propelling apparatus, and handles are all insulated from the main frame and from each other. The ground return voltage terminal of the instrument is grounded by a jumper connection to a trailing 30-ft. bare ground cable.

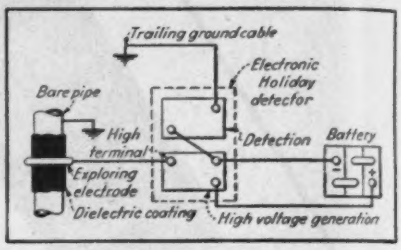
The apparatus is so designed that with proper length exploring electrode, it is applicable to pipe sizes from 2 in. up.

To conserve the storage battery as much as possible, 30 impulses per second are used, as that rate is sufficient to provide adequate coverage if the pipe is traversed at a normal walking rate. For this reason the generator of the Detector has its output chopped into these 30 oscillatory or testing surges.

Immediate cut off of the high voltage discharge on reaching a holiday protects the coating from carbonization. The operator is assured that a holiday exists somewhere within the narrow area encased by the exploring spring when the alarm rings. The actual location is then determined by visual inspection for the sparking point; this spot is then marked for later treatment and the operator moves on.

Using this equipment a 2,000-ft. section of 8-in. pipe was inspected in one hour of total elapsed time, during which 360 holidays were encountered, located and marked.

AUTOMATIC electronic device with oscillatory generator, controls, and exploring electrode to locate flaws in pipe coating. The electronic, bell and counter circuits are controlled by one multitap switch



SCHEMATIC diagram of the Electronic Holiday Detector

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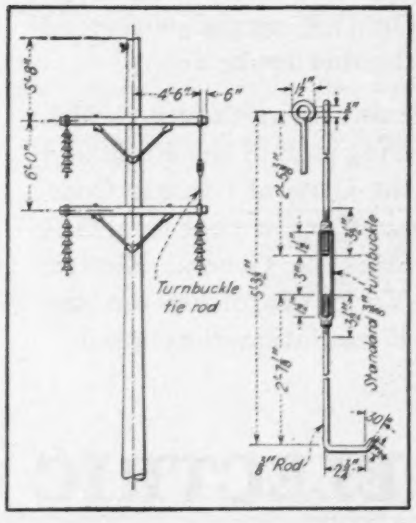
Turnbuckle Tie Rod Equalizes X-Arm Loading

To equalize the load on opposite ends of the top crossarm of both tangent and dead-end 66-kv. transmission poletops, Central Illinois Public Service Co., Springfield, installs a ⅝-in. turnbuckle tie rod between the top and bottom cross-arm on the unloaded end as shown above. The sketch shows tie rod details.



Inhibiter Reduces Contact Resistance

By T. G. HIERONYMOUS
Supt., Underground Systems Dept., Kansas City Power & Light Co. Kansas City, Mo.

An incident occurred recently in Kansas City which points up the fact that where one of a pair of parallel d.c. cables runs hot it is well to look to the cold cable for trouble as well as its mate.

The case in point concerns d.c. underground service of four 1,500 M.c.m cables; two paralleled positives and two paralleled negatives and a 2,000 M.c.m. neutral.

One of the 1,500 M.c.m. cables was running hot. During a light load period a maintenance man took the hot cable out of service, cleaned the contacts on the bolted lug and fuses at both ends and restored the cable to service.

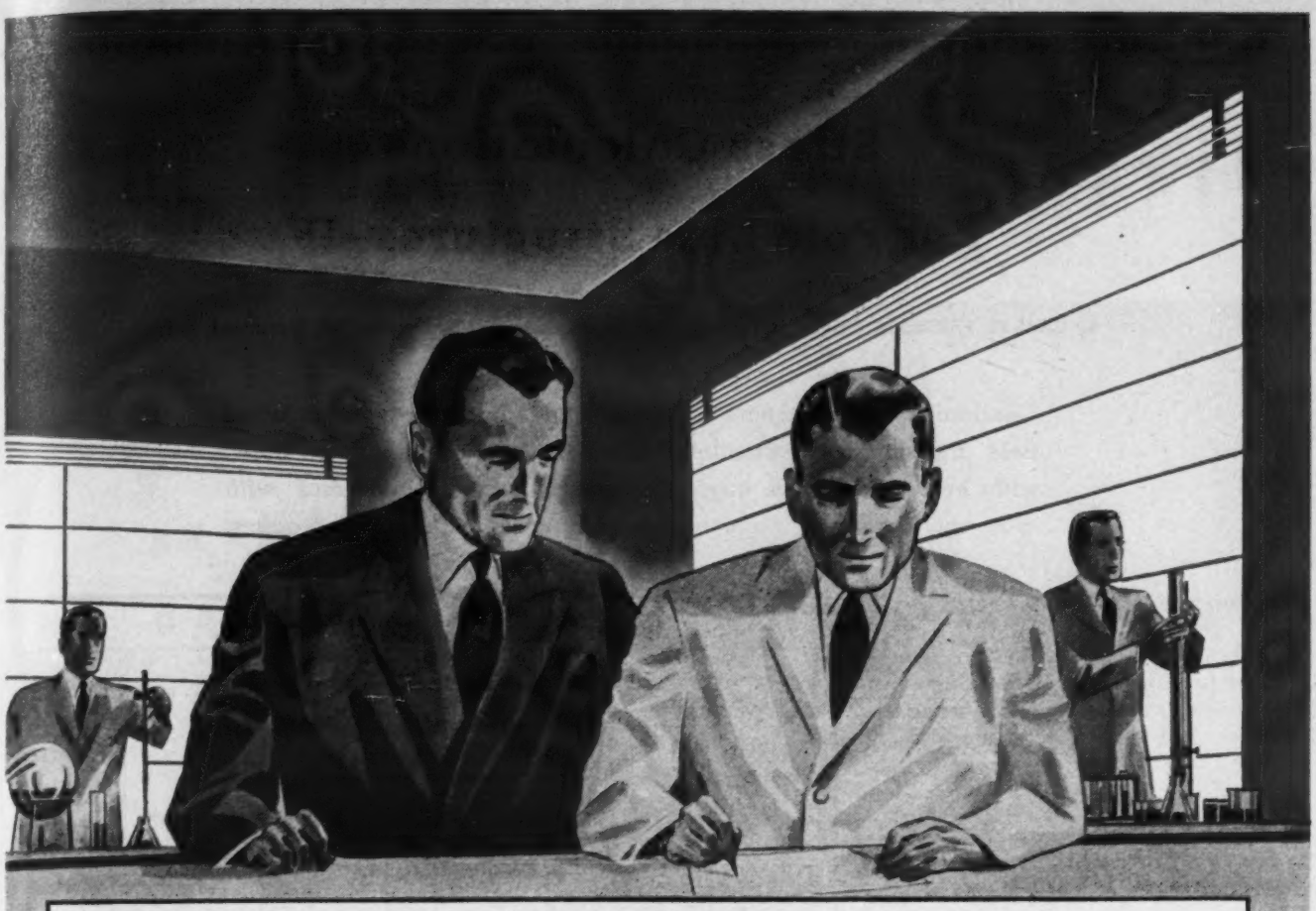
Once more the cable was reported hot; it was carrying all the load. The trouble was in the contact resistance of its mate, the cold cable.

When the cold cable was de-energized, contacts cleaned, coated with oxidation inhibiting compound and restored to service, it immediately started carrying its share of the load.

Such case have been definitely whipped by the judicious use of a vaseline-base preservative compound (No-Oxide) containing chromium as an oxidation inhibiting agent.

Our practice is to use this compound on all fuses and bolted connections carrying current. With it we have cut maintenance problems due to high contact resistance to an all-time low. When mixed with a little coal oil and applied with a brush to the threads of bolts, especially black iron bolts subject to rusting, nuts are easily removable even after years of service. When applied to bolts set in concrete this treatment stops all rusting.

We have had experience with the 4½-in., black-iron, hold-down bolts for metal street lighting posts rusting out in three or four years. Treated with compound these bolts remain in excellent condition after many years of service.



WHAT IS MOSINEE *Paperology?*

Just as metallurgy scientifically controls alloys to meet requirements of strength, toughness, hardness, corrosive action, etc., in *metals*, Mosinee Paperology now offers scientific control of paper characteristics.

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Stress Calculations For Pole Line Structures—II*

By CARL G. ERICKSON, Electrical Engineer, Northern Indiana Public Service Co., Hammond, Ind.

Continuing the essentials of stress calculations for various wood pole transmission structures, this article covers single poles with brace and with guy. Subsequent articles will deal with two- and three-pole structures having various forms of bracing.

Single Pole With Brace Or Guy

Figure 2(a) represents a pole supported by a brace or strut. By the summation of moments about appropriate points, reactions and stresses are obtained as follows:

Vertical Reaction $R_1 = \frac{Ph}{X} - (W + W_1)$

Vertical Reaction $R_2 = \frac{Ph}{X}$

Horizontal Reaction $H_1 = \frac{Ph_1}{h_2}$

Horizontal Reaction $H_2 = \frac{Ph}{h_2}$

Compression stress, strut C $c = \frac{H_2}{\sin \theta}$

It is obvious that H_1 decreases toward zero as point "a" approaches the point of attachment of load P, while at the same time the compression stress in the strut decreases to a minimum; also H_2 decreases toward a value equal to P. If another pole were installed as shown dotted and the strut attached to it, no stresses would be changed except R_2 would be increased by an amount equal to W_1.

Some of these conditions are reversed when a pole is guyed as in Fig. 2(b).

$$R_1 = \frac{Ph}{X}$$

$$R_2 = \frac{Ph}{X} + W + W_1$$

$$H_1 = \frac{Ph}{h_2}$$

$$H_2 = \frac{Ph_1}{h_2}$$

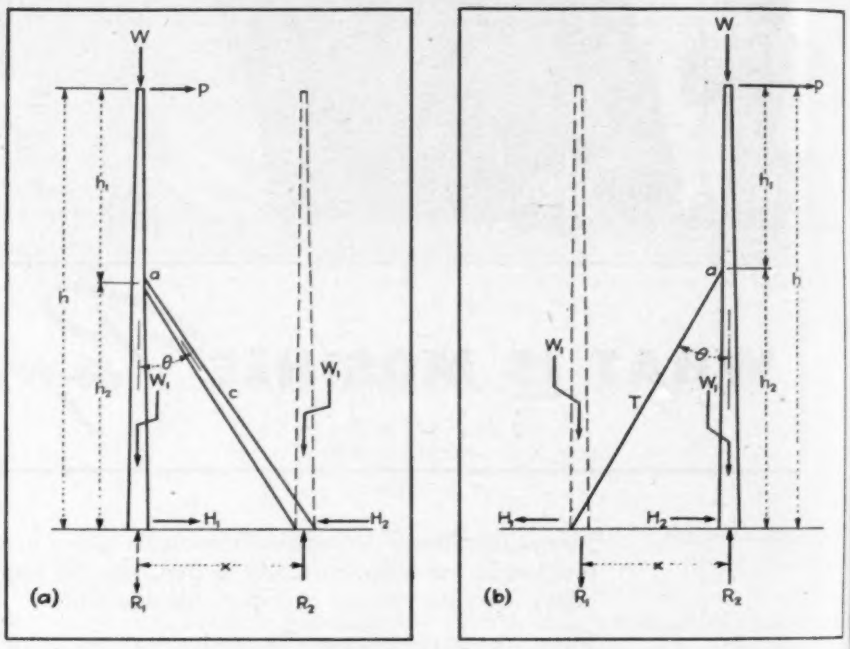


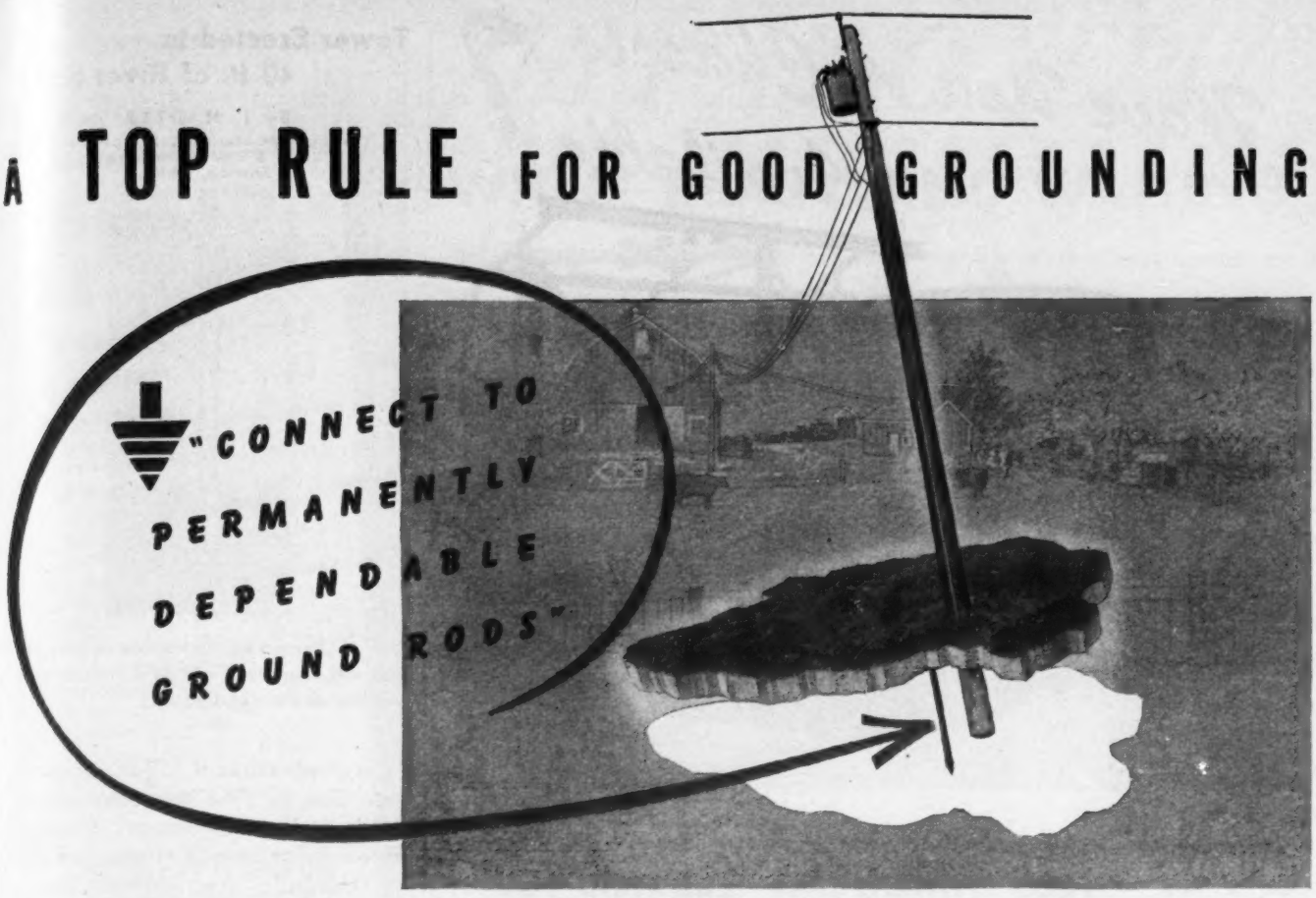
FIG. 2—Load diagrams for (a) single pole with brace and (b) single pole with guy

The tensile stress t in the guy T equals $\frac{H_1}{\sin \theta}$ The value of H_1 decreases as point "a" approaches the point where load P is applied to the pole while at the same time the value of H_2 approaches zero. If we install a companion pole in this case as indicated by the dotted line in Fig. 2(b), and attach the bottom end of the guy to this pole, then R_1 is reduced in value in amount equal to W_1 which may require the direction arrow of R_1 to be reversed to indicate a downward thrust rather than an uplift as shown.

A cross arm attached to the two poles with the usual symmetrical loads would not divide the load equally between each pair of poles as in Figs. 2(a) and 2(b). Deflection δ would be the same for the guyed or braced poles as for the companion poles shown in dotted lines. Hence, it can be reasoned that the braced or guyed pole would support more than one half of load P.

*This series began in *Electrical World*, May 13, 1944, issue.

A TOP RULE FOR GOOD GROUNDING



If ground rods were uprooted, you would see the tens of thousands of Copperweld ground rods giving dependable service today. The stiff steel core that makes driving easy is protected from rusting by a thick exterior of copper. And when a copper ground wire is clamped to a Copperweld ground rod, there are no dissimilar metals in contact—the connection is "copper-to-copper."

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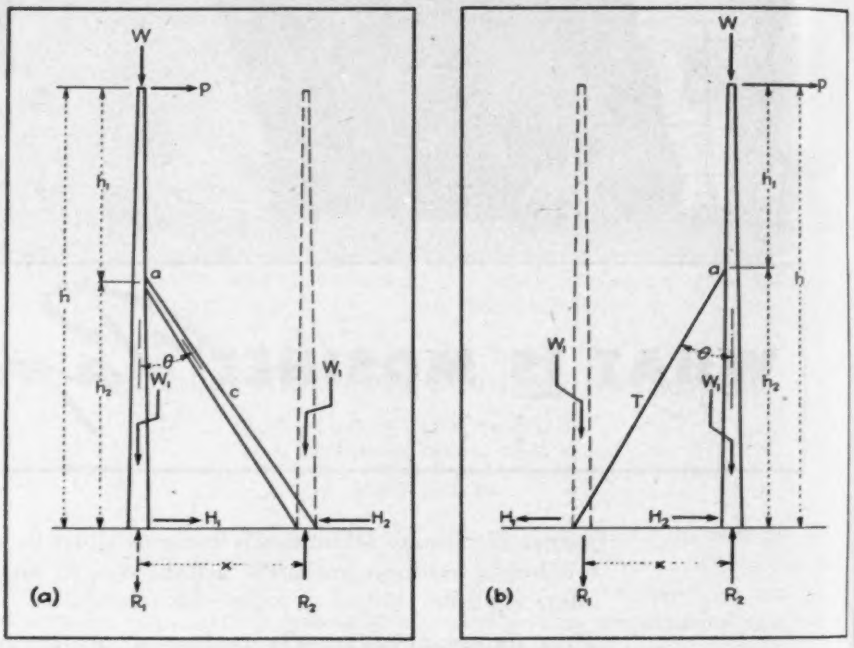

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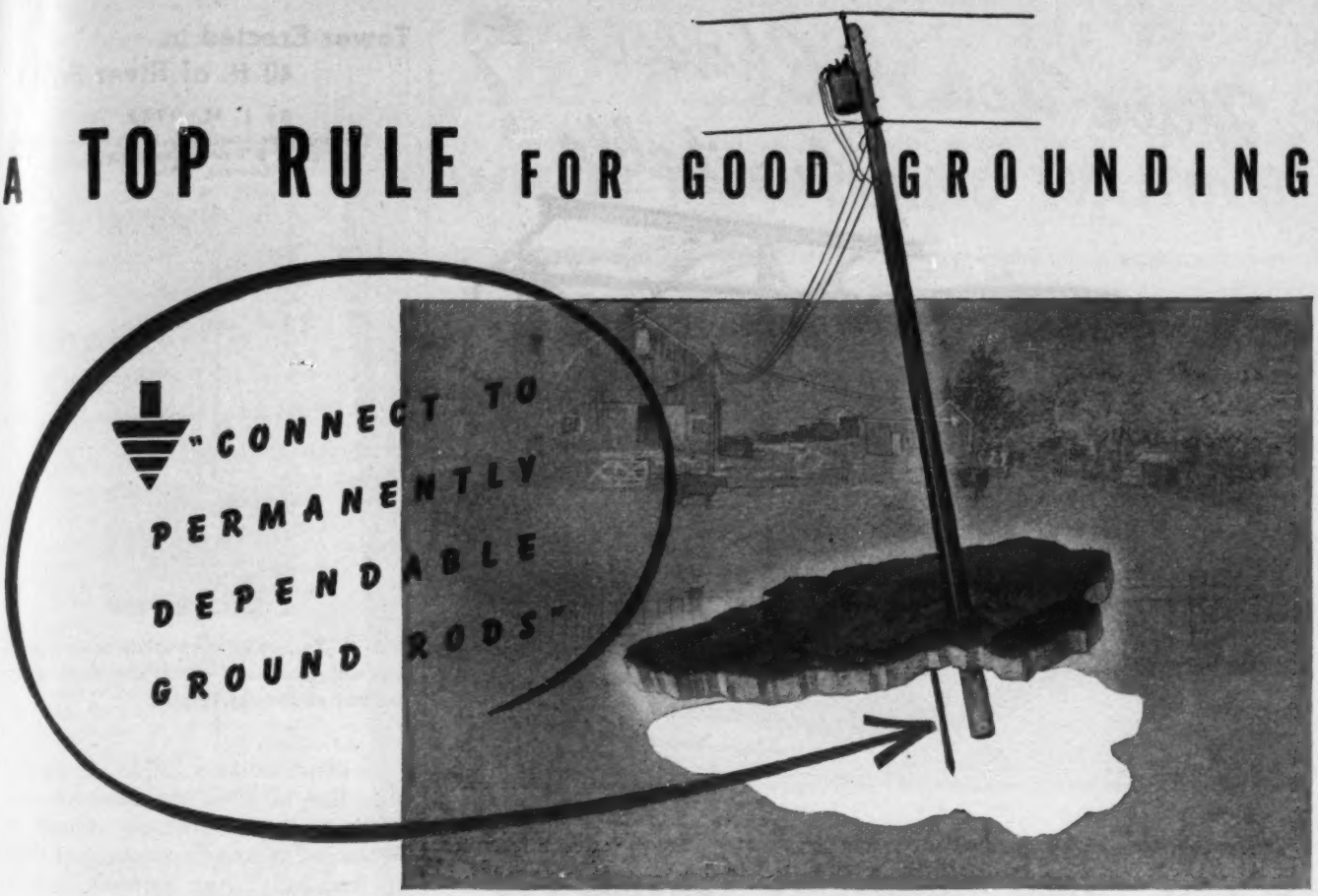

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Tower Erected in 40 ft. of River Sand

By J. M. DYER

Transmission Engineer, Southwestern Light & Power Company, Lawton, Okla.

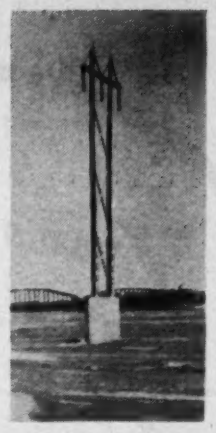

FIG. 1—Transmission structure in river bed has withstood flood waters and drifts without any shifting or leaning

In constructing a 138-kv. transmission line in 1941 the Southwestern Light & Power Company found it necessary to cross a stream bed that is frequently dry, normally has a very small stream flowing, and approximately twice a year is in flood stage. Highest stage at point of crossing that has ever been recorded is 8 ft. above river bed. The bed of this river in the immediate vicinity varies from 2,500 ft. to 5,000 ft. in width. This particular point for a crossing was chosen because of a bluff on the south side to assist in gaining height. It was found necessary to place a structure in the river bed on account of priorities, etc., just then being invoked and inability to obtain a steel tower.

A location for the structure was selected that seemed to be least susceptible to flood damage, and as it so happened, this location would enable a crew to work on dry sand, except for rises in the river. This resulted in a span of 2,084 ft. on one side of the structure across the main part of the river and a span of only 725 ft. in the other direction. The crossing is at right angles to the stream flow.

Two holes 30 in. in diameter were drilled to a depth of 60 ft. at which point fairly firm footing was found. The first 35 to 40 ft. was drilled through quicksand (which when the river had water in it was merely sand in suspension) and the remaining 20

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❸ GOES INTO ACTION INSTANTLY AND AUTOMATICALLY, QUENCHING THE FIRE QUICKLY AND COMPLETELY

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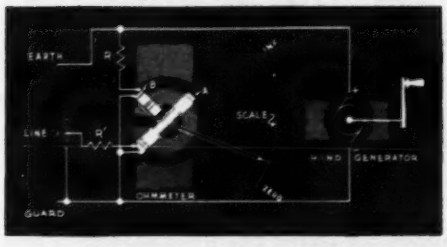

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In what we term a cross-coil true ohmmeter, two coils are mounted in fixed relation to each other on the same pivot-and-jewel moving system in the field of a permanent magnet. "Current" flows in coil A and "potential" in coil B, and they are connected so that their respective torques oppose each other. Since there are no control springs, the opposing coils give a true ratio of E/I, and ohms (or megohms) are indicated directly by a pointer over a scale. The readings are independent of the voltage of the hand-driven d-c generator, because any change in the voltage affects both coils in the same proportion.

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FIG. 2—Base of river crossing structure for 138-kv. transmission line

to 25 ft. through a mixture of sand, red clay and small, round rock. In the two holes were set 24-in. pipe, projecting 4½ ft. above the surface of the sand. This pipe was then filled with steel reinforced concrete. Lengths of 15-in. I-beams fabricated from 15-in. channels were then lowered inside the 24-in pipe, lapping the steel reinforcement, allowing the beams to project 21 ft. above the surface of the sand, the total length of beam being approximately 46 ft.

Then beginning at a point 3 ft. below the surface of the sand and extending above it 9 ft. a reinforced concrete pier was poured, 12 ft. high, 24 ft. 6 in. long and 4 ft. wide, tapering at its ends, and parallel with the stream flow. The fabricated I-beams on 14 ft. 6 in. centers projected 12 ft. above the pier. Beam clamps were designed to fasten a pole to the beam and a regular tangent structure was erected and clamped to the beams, using three sets of X-braces for transverse bracing.

The structure supports 3/0-S-Copperweld-copper conductors and 2⅜-in. galvanized steel shield wires.

One month after completion there occured a 7 ft. rise on the river and the structure withstood the flood waters and drifts without any shifting or leaning. Due to the fact that the 40 ft. of sand when filled with water offers no support whatever, and that the structure has withstood a flood within 1 ft. of the highest recorded, it is felt the design and construction is good for this type crossing. Due to the shifting of the sands during rises on the river, one rise may remove the sand for a foot or so and the next rise may bank it up to a depth of 2 or 3 ft. around the pier, but with no

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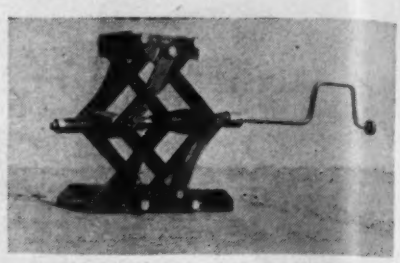
disturbance yet of the structure stability, after two years of operation.

•

Jack for Lowering Oil Switch Tank

By GEORGE BOEHME and E. SHACKLEFORD

Pacific Gas & Electric Co., San Jose, Calif.



TRUCK-TYPE jack made from scrap solves problem of lowering switch tank in close quarters

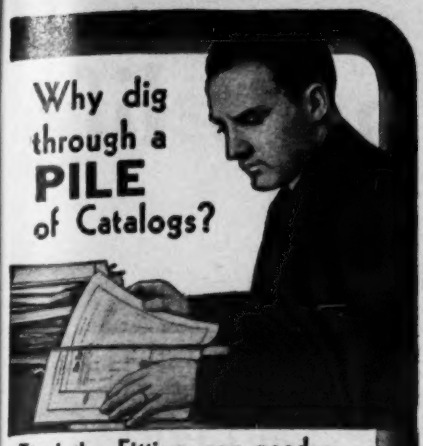
Difficulties experienced in lowering the tank of a 4-kv. oil circuit breaker led to development of the jack illustrated. It is similar to a truck jack, having a double toggle action with right and left hand screw, and is operated with a socket wrench. Metal picked up from the scrap pile provided the material.

The particular breaker occupies practically all the space in the switch cell and the tank lowering device for other switches could not be used. Likewise, attempts to provide tackle, using blocking with a bar and other ideas all proved time-consuming and hazardous. A jack of the type shown is easily built and might well find many other uses.

•

Linemen's Safety Belts Reinforced

As is the case with many other materials in wartime the quality of leather in linemen's safety belts is sometimes not so good as it used to be. It has been found desirable in the Roanoke Division of the Appalachian Electric Power Co. to reinforce belts at the place of quickest wear. This is a length of about 14 in. back from the buckle on the inside of the belt where it rubs on the pole. The reinforcement consists of a piece of about $\frac{1}{4}$ in. harness leather which is stitched to the strap. Before stitching, the leather is channeled out about $\frac{1}{8}$ in. deep along the lines of the seams. Thus the stitches are recessed and are not exposed to wear.



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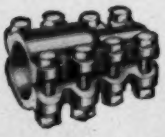

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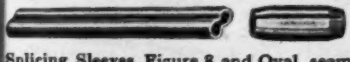

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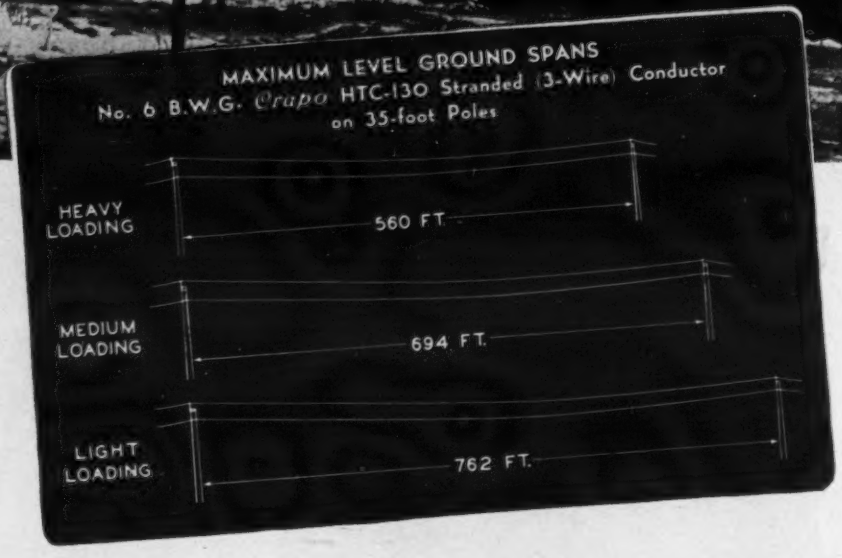

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LIGHT	1.00	2.78	5.40

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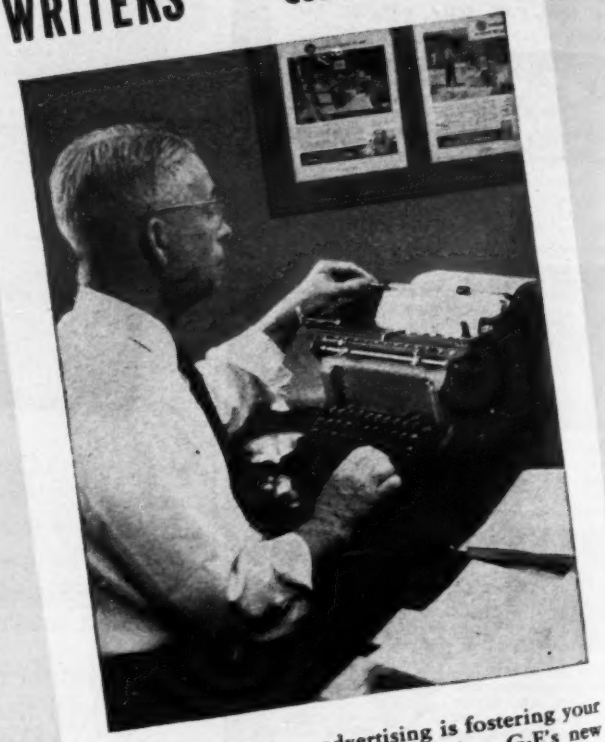

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postwar lighting standards

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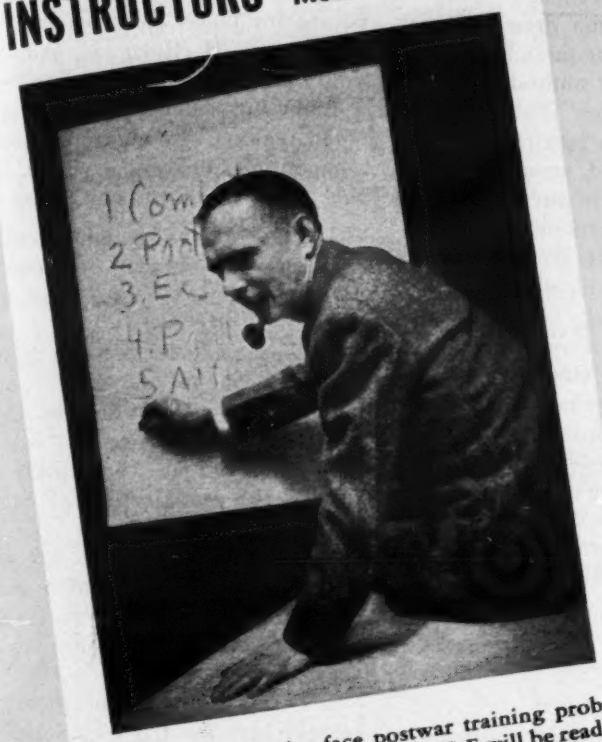

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RESEARCHERS . . Progress Depends on Knowledge

Longer, slimmer fluorescent lamps, circular F lamps, and instant-starting F lamps are just a few of the new lighting tools, developed by G-E research scientists, which will be available as soon as the more urgent task of winning the war permits

Architects and designers, writers and artists, teachers and training schools, lamp research men and engineers . . . all are being united by G-E in one broad program to help you, the men you will employ, and your customers to get the most out of postwar lighting. G-E appreciates the contributions of many lighting companies to the development of this program. General Electric Lamp Department, Nela Park, Cleveland, Ohio.

"TO MAKE G-E LAMPS STAY BRIGHTER LONGER"

The Constant Aim of G-E LAMP RESEARCH

G-E MAZDA LAMPS

KEEP BUYING WAR BONDS—KEEP THE WAR BONDS YOU BUY

LOAD SERVICING

Commercial
Industrial

Residential
Rural

Scouts Canvass For Idle Home Appliances

With the incentives of patriotism, prizes and competition to spur them on, 1,000 Boy Scouts and Sea Scouts of Chicago's south side have embarked on a house-to-house campaign to coax out of hiding idle electrical appliances needed by war-busy "Windy City" families.

The drive, which is in the nature of a "trial balloon," is expected to give considerable impetus to the appliance swap program launched by Commonwealth Edison Co., on Oct. 18. Chicagoans receive war stamps in exchange for out-of-service appliances. Participating dealers recondition and resell the devices.

The scout project with 29 local troops taking part in the canvass was launched April 26. Up until that time 25,037 idle appliances had been turned in to participating electrical dealers in the 28 weeks since the swap program started in Chicago.

Scouts during the drive will ask housewives to scour their homes and exchange whatever unneeded or out-of-date devices they find for war stamps. Giving a receipt for every item to be swapped, scouts will then take the appliance to any of the local neighborhood electrical dealers cooperating. Dealers arrange to pick up large devices such as washers and refrigerators.

In addition to receiving a "commission" in war stamps from the dealer for each device obtained, the scouts are given an established number of points, depending on the type of appliances, which count in the competition for individual and troop prizes. The five scouts with the highest score on June 30 will win a two-weeks vacation at the Chicago Council Camp, Owasippi, Mich. Other prizes will consist of various items of scout equipment. The five leading troops in the contest will be awarded troop paraphernalia and every scout with 100 points or more to his credit will earn equipment equivalent in value to one cent for each point.

BOY SCOUTS Berglund, Stone and Baker listen as E. M. Ball, Commonwealth Edison Co., explains the Troop Honor Roll Score Card to be used in Scout house-to-house canvass for idle appliances. Looking on are Sam R. Davis, right, community war service chairman heading the scout drive and Robert Oliver, Proctor Electric Co., "daddy" of the national appliance swap plan

•

The Whys of Diesel Competition Post-War

Telling at a meeting of the Southeastern Electric Exchange why his company put on a special training course for power salesmen on diesel engines, R. H. Reynolds, industrial power engineer of the Carolina Power & Light Co. stated in succinct terms seven reasons why vigorous post-war competition may be expected from this form of isolated plant. They are:

1. The war has brought about tremendous development of diesel engines, especially the small high-speed types.

2. Great publicity is being given to the diesel engine and to the part it is playing in winning the war.

3. Factories that are now building diesels for war use can quickly convert to the manufacture of engines for peace-time uses.

4. In the armed forces are many men trained in the operation and repair of diesels who will seek the same kind of work when they are discharged.

5. Diesel engine manufacturers will be searching far and wide for a market for their product.

6. Since a large part of the development expense of the manufacturer has been absorbed by the war production, he may be in position to sell at low prices.

7. We will be forced to meet this competition immediately after the war and we believe it is going to be very severe.

•

High Frequency Heat Sets Yarn Twist

Analagous to stress relieving in metals, heat is used to set the twist in textile yarns, resulting in a tighter, stronger product. Long established practice is to heat the ball or cone of yarn by convection, which restricts the mass to comparatively small size.

Now comes the Industrial Rayon Corporation with a new method by

Kelvinator Breaks National Magazine Campaign to Help Dealers & Service Men during Critical Summer Months

Promotes User Cooperation on Service When It Is Needed Most!

Tying in with the nationwide "Better Care—Less Repair" activity, Kelvinator's Summer Service Program is aimed to show consumers how to keep their refrigerators and ranges at peak efficiency for the duration . . . to help cut down needless service calls . . . to gain "good will" for the Kelvinator dealer by obtaining customer understanding and cooperation when delays in handling service calls are unavoidable. It is a program to help the dealer—by helping his customers.

Two Wartime User's Guides

Kelvinator's Wartime User's Guides for refrigerators and electric ranges tell customers how to diagnose and report trouble accurately, so needless service calls will be unnecessary. These booklets are designed to help the owner and build good will for Kelvinator dealers. Available, *free*, to all Kelvinator dealers.

Magazine Advertising Has Combined Circulation of over 16,000,000

Appearing at the beginning of the service rush season, attention-getting, colorful ads will appear in magazines that reach 16,000,000 readers. Among these readers are your pre-war customers . . . and your post-war prospects. Striking illustrations dramatize the need for customer cooperation in helping dealers render efficient service. And the new Kelvinator User's Guides are offered in each ad. See this advertising in the *Saturday Evening Post*, *McCall's*, *Better Homes and Gardens*, *Good Housekeeping*, *Household and True Story*.

Special Dealer Helps Available

A complete set of human interest double and single column newspaper mats are available for dealer's use in telling the Kelvinator Service story locally. There are also one-minute spot radio announcements, friendly letters for mailing to customers and a handy *Telephone Conversation Guide* to assist you in handling service telephone calls efficiently.

Service Program Plan Book

The entire Kelvinator Service Program is completely outlined in this aptly named Plan Book, "Keeping Friends through Wartime Service." If you haven't received your free copy, contact your nearest Kelvinator Zone or distributor.

BETTER CARE — LESS REPAIR

The men and women of the Propeller Division of Nash-Kelvinator Corporation have been awarded, and proudly fly and wear, the famous Army-Navy "E" for High Achievement in War Production.

LOOK AHEAD WITH KELVINATOR

DIVISION OF NASH-KELVINATOR CORPORATION

Kenosha · Milwaukee · DETROIT · Grand Rapids · Lansing

X MARKS THE SPOT

An inferior light fails. X marks the spot where the criminal makes his approach without warning.

A defective lamp does not fulfill its rated lamp life. X marks the spot where the accident occurred. Yes, the tragic magnitude of night traffic fatalities should compel attention to the need for better lighting.

And X marks the spot where a "weak" lamp reflects an area of dangerously low visibility . . . and death again takes its toll.

Obviously, the manufacture of an incandescent street lighting lamp places a great responsibility upon the maker. That is why for many years SLATER illuminating engineers have strived only to produce the best . . . to have each lamp provide maximum lighting efficiency and deliver an extremely high lumen output . . . to assure correct lighting and long lamp life, under all conditions. *Catalog upon request.*

SLATER ELECTRIC & MFG. CO.

BROOKLYN, NEW YORK

MANUFACTURERS OF STREET LIGHTING LAMPS, AND PRECISION ELECTRONIC TUBES

which the yarn is heated by high frequency electricity. The process is used in the production of rayon tire cord. Heat generated in the cord is distributed so uniformly that cones containing 18 pounds or more may be effectively treated. Such giant cones are used in the weftless method of tire construction.

The process is completed in a matter of minutes and results in the production of a cord in which the twist is uniformly set. Control of the moisture content of the cord is effected by wrapping the cones of cord in moistureproof paper and processing them in this form.

The equipment originally installed for this process has been in operation at Industrial Rayon's Cleveland plant for more than eight months and includes high frequency power generating units having outputs of approximately 22,500 Btu. per hour each. They were furnished by the Girdler Corporation, through its Thermex Division, and each unit is capable of handling several thousand pounds of packaged tire cord in a 24-hour period.

CONES OF RAYON tire cord emerge from high frequency oven

Additional high frequency twist-setting units are to be installed by Industrial Rayon to care for the expanded capacity of its Cleveland plant and the new tire cord department of its Painesville plant, both f which are scheduled to enter production in the third quarter.

Patent applications covering the use of high frequency heating for twist-setting of textile products generally, including tire cord, have been assigned to Industrial Rayon. The new process is also being used

L-M "PVD" FUSE CUTOUTS *always work*

● Operation of L-M "PVD" Fuse Cutouts is entirely independent of the door. Even if the door should become stuck from any cause, the "PVD" will always operate as a drop-out or disconnecting cutout.

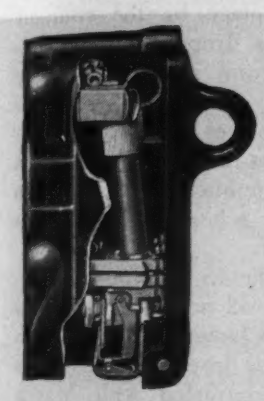
The fact that the door of the L-M "PVD" Fuse Cutout always remains closed means that working parts are fully protected at all times.

Positive, heavy contacts with large contact surfaces and elimination of intermediate current-carrying parts keep "PVD" operating temperatures low.

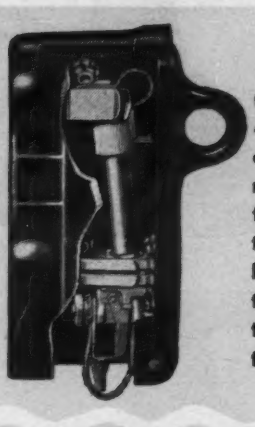
Arc is positively extinguished before any contacts move or separate. Then the large air gap prevents any re-establishing of the arc.

Tell-tale position of the dropped-out cartridge is readily visible from any direction and from a distance. Re-fusing is but a one-minute operation and can be done right on the pole, even with gloved hands.

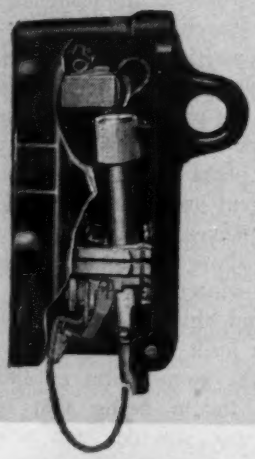
For full information, write Line Material Company, Milwaukee, Wisconsin.



1 L-M "PVD" Fuse Cutout is always protected. Rugged Bakelite door remains closed at all times, sealing contacts and working parts from weather, dirt and corrosion.

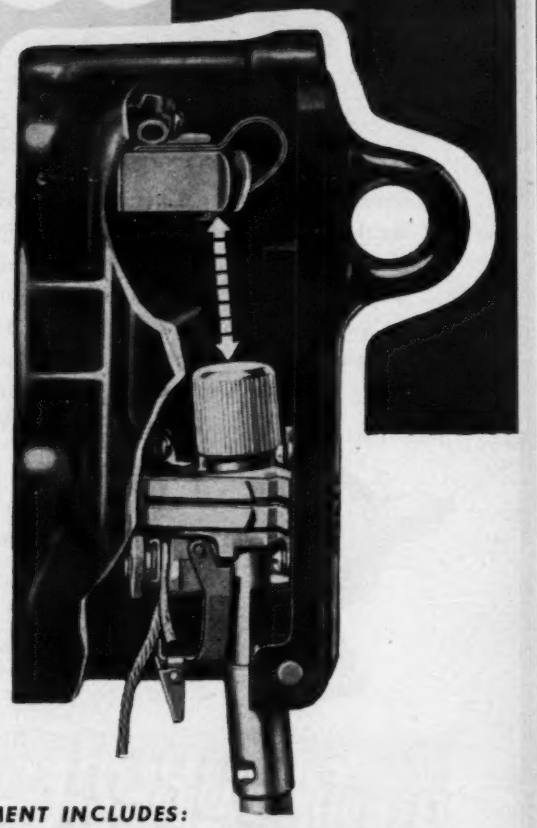


2 Flip-out device snaps down and assures instant separation of the blown fuse link parts before the latching lever releases the tube to the indicating position. There is a positive time delay.



3 Arc is cleared inside the tube before the contacts separate. Upper contact follows when dropping, thereby maintaining contact during a good portion of the downward travel of the tube, absolutely assuring that the arc is cleared.

4 Large air gap between the contacts, when the tube has dropped to the indicating position, definitely prevents any re-establishing of arc. There is no leakage, no radio interference. "PVD" action is dependable and positive under all weather conditions. Dropped out tube is a signal seen from the ground.



Six seconds is plenty of time to re-fuse the "PVD". On-the-pole re-fusing is a safe, easy operation.

L-M DISTRIBUTION EQUIPMENT INCLUDES:

Transformers • Fuse Cutouts • Lightning Arresters • Oil Switches • Pole Line Hardware • Line Construction Specialties • Underground Equipment • Fibre Conduit • Street Lighting Equipment

LM LINE MATERIAL COMPANY

FUSE CUTOUTS

PITTSBURGH *Permaflector*

INDUSTRIAL UNITS

E-530-B PERMAFLECTOR not housed.
I-1005-N with retaining ring.
D-530-N DUALIGHTS provide perfect blend of mercury and incandescent illumination.

Permaflector silvered-glass units provide highly efficient, engineered light control for every industrial lighting requirement . . . general or localized . . . ceiling or sidewall installation . . . high or low bay mounting . . . for medium, broad, or concentrated distribution . . . for lamp wattages of 100 to 1,500 watts . . . with incandescent, mercury vapor lamps, or a combination of both . . . mounted as single units or on dual hangers. Sold on priority thru Electrical Wholesalers.

FLOODLIGHTS

Rugged in construction · weather-proofed and corrosion-resistant · equipped with famous silver-mirrored glass Permaflectors. Available in 200 to 1,000 wattages, and broad, intermediate or concentrated light distributions. Complete. Ready to set up.

PITTSBURGH REFLECTOR CO.
OLIVER BLDG., PITTSBURGH, PA.

ILLUMINATING ENGINEERS DESIGNERS & MANUFACTURERS of COMMERCIAL & INDUSTRIAL LIGHTING EQUIPMENT

• Now producing confidential lighting equipment for the Armed Forces and supplying Industrial users on priority (Commercial replacements from stock). Startling new post-war developements now in work will soon be announced.

by the B. F. Goodrich Company, under license from Industrial Rayon, in connection with production of rayon tire cord. Radio Corporation of America supplied the high frequency power units used by B. F. Goodrich.

•

Talks To Pupils Cut Sling Shot Sabotage

By C. R. TRACY
Illuminating Engineer
Sioux City Gas & Electric Co.
Sioux City, Iowa

Street lamp, globe and hood breakage, largely traceable to mischievous sling-shot sabotage by the younger generation has dropped off an estimated 50 percent since Sioux City Gas & Electric Co., took its story to children themselves in a series of educational talks and demonstrations in Sioux City public, parochial grade schools, high schools and colleges early this year.

Following the 46 talks on the subject given in 42 schools to 14,346 pupils between January 12 and March 14 this year, the drop in breakage was heartening. Contrasted with March last year when 99 lamps were broken, only 53 were broken in the residential section this March. Only six electrolier globes and lamps were broken this March; eleven, a year ago. As an incentive for the children to keep up the good work during vacation days the company plans to announce soon that—contingent on reduced breakage this summer—it will arrange a safety magic show in all the schools next fall and winter.

Talks around which the educational program was built featured a showing of a G.E. sound film entitled "2311," the theme being that to shorten the war one day can save 2,311 lives. Following the pictures, assemblies were told that their power company had a problem they could help to solve and in so doing would perhaps help shorten the war.

A complete street lighting unit—radial-wave reflector, hood, lamp bulb and socket—was shown and its parts identified. Here the point was made that bulbs were rationed; that critical materials used in them, such as brass and tungsten, had gone to war. The boys and girls learned that the cost of the 1,091 bulbs broken last year, if converted to money, would buy 3,114 50-caliber machine gun bullets, three for each lamp.

Three such bullets were shown to the group.

Similarly with the hood. A broken one was shown which had been struck with a stone. Cost of the hood was given as $15.20, and representing 72 more 50-cal. bullets.

Next came the socket with a broken and a good one displayed. Children were told of the danger of removing sockets from bridge installations as had been done, or of touching any hanging wire.

A stone-damaged, radial-wave reflector, looking much like a target in a shooting gallery, was next displayed. This reflector, pupils were told, is made of essential steel and porcelain that chips easily. Its $5.25 cost represents 21 more 50-cal. bullets.

Electrolier globes in the business section of the city were next discussed; of these 106 were broken last year. At $10.50 each the cost represents 3,900 bullets. When the outer globe is broken the lamp bulb is likewise lost and the cost is another 505 bullets.

In high schools and colleges mention was made of the unseen expenses including 2,400 additional truck miles, wear and tear on tires, 261 gallons of gasoline and labor amounting to $469 involved in servicing residential street lamps. These advanced students were shown that this expense all comes out of the taxpayers pocketbook.

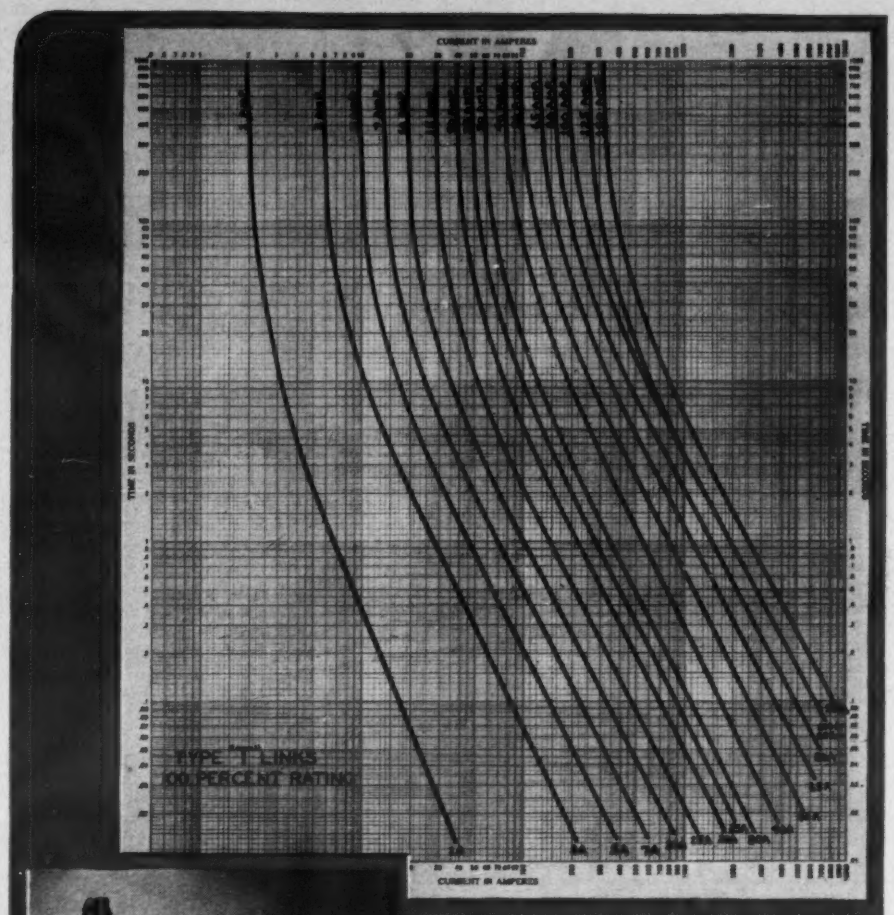
Response from the school children was splendid. During and following the series, 60 letters have been received from boys and girls in the schools. Parents who were told of the program by sons and daughters have written in. Teachers and principals in all schools have been high in their praise.

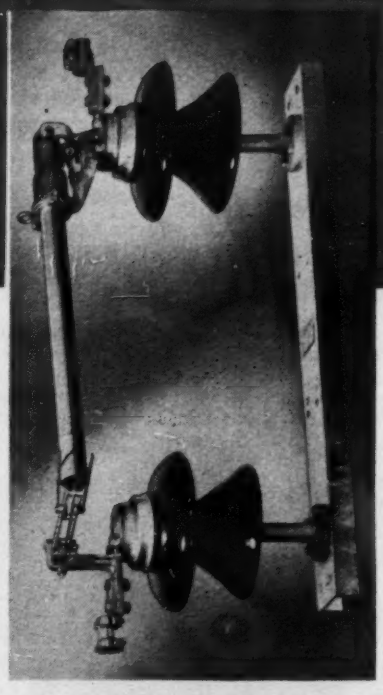
As a result of experience with this program the company is convinced that every school child is most patriotic and now that they have been told of the extent of the damage they will seek harmless targets for their "fun."

•

Co-op to Acquire Utility

Sale of the electrical properties of the Citizen's Electric Co. of Missouri, in Miller and Pulaski counties, to the Laclede Electric Co-operative of Lebanon, for about $120,000 has been authorized by the state commission, by a vote of four to one.





4000 Faults cleared last year by HI-VOLTAGE FUSES at a cost of new fuse links only

• The Time-Current Characteristics provide protection for equipment and also service on the line.

They are timed for the high side of transformers and can be coordinated with load, fault currents and circuit breaker settings.

Hi-Voltage Fuses are built in Standard, Heavy Capacity, and the Extra Heavy Capacity size with a rupturing capacity of 1,000,000 KVA.

HI-VOLTAGE
EQUIPMENT COMPANY
2891 East 79th Street • Cleveland 4, Ohio

NEW EQUIPMENT

Electronic relay: operated by any material with resistance of from 0 to 500,000 ohms. **General Electric Co.**, Schenectady, N. Y.

Electronic Relay

Designed to amplify limited current transmitted by delicate control contacts or high resistance circuits, new electronic relay is suitable for controlling liquid levels in tanks and boilers, sorting metallic parts by size, and as a limit switch requiring extremely light pressure to operate. Device consists of standard type electronic tube, a supply transformer and an electromagnetic relay, all totally enclosed, suitable for wall or machine mounting.

•

Luminaire

"Excelux" luminaire: utilizes four 40-watt fluorescent lamps; available for unit type installations in close ceiling and suspension models. **Edwin F. Guth Co.**, 2615 Washington Ave., St. Louis 3, Mo.

Lighting unit with "glass and plastic" forms has been designed for administration areas, general offices and drafting rooms. Full-screen diffusion is said to be provided through a diffusing-shield which consists of continguous multiple prisms. For relamping a retaining end-hinge permits the shield to be disengaged from the fixture chassis.

•

Inductor Coils

Miniature air inductor coils: supplied in diameters from ½ to 1¼-in., each available in any winding pitch from 44 to 4 turns per inch; wire sizes from No. 14 to No. 28. **Barker & Williamson**, 235 Fairfield Ave., Upper Darby, Pa.

Coils of "air wound" construction are adaptable for high frequency radio and other electronic applications. Any type mounting can be supplied and the coils can be equipped with fixed or variable, internal or external coupling links.

Dust Collector

"Dustkop" portable dust collector: for 25- or 50-cycle circuits; fan speed 3,450 rpm.; air speed in inlets 4,450 fpm. **Aget-Detroit Co.**, 602 First National Bldg., Ann Arbor, Michigan

Self-contained unit, suitable for medium duty grinding and other dust creating abrasive operations has a fan mounted on a shaft which in turn is carried on ore-lubricated and sealed ball bearings. Fan is operated through a vee-belt overdrive and motor. Available with either one or two inlets, the unit may be connected to dust source by means of standard size flexible metal hose or sheet metal pipe.

•

Reflector

"Cat. 587-T-X-Ray" Silver Mirror reflector: for 750-watt bi-post lamp. **Curtis Lighting, Inc.**, 6135 W. 65th St., Chicago 38, Ill.

For general factory and high-bay installations, new reflector has gray finish on all metal parts and "Golden Armor" on the reflector. Duplex hanger may be used whenever the reflectors are to be hung in pairs.

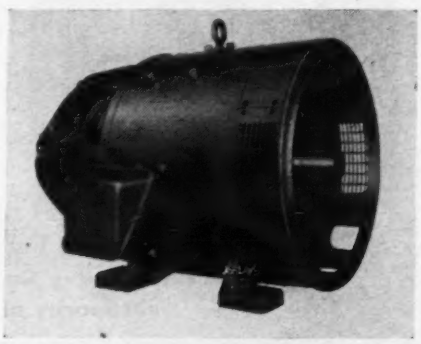
•

Rectifier Tubes

"CE-200," "CE-201" mercury vapor rectifier tubes; former has standard 4-pin base, latter has a long-pin industrial base. **Continental Electric Co.**, Geneva, Ill.

Improved 2-amp. full-wave rectifier tubes are suitable for applications up to about 250 volts, d.c. They are said to have low average arc drop and to assure minimum internal heating.

•



Dirct current generator for direct assembly to engine frame or for belted drive: sizes 1 to 200 kw.; 15 to 600 volts. **Century Electric Co.**, 1806 Pine St., St. Louis, Mo.

Generator

Construction to bolt directly to the engine housing and engine shaft, direct current generator is equipped with one ball bearing. Engine end of the rotor is supported by the engine bearing.

Model "665" V.T. Ohmeggor insulation tester: 13 a.c. and d.c. voltgae scales, measuring from a fraction of a volt up to 6,000 volts, with 29 ranges; tests at 500 volts up to 10 megohms. **Radio City Products Co., Inc.**, 127 West 26th St., New York 1, N. Y.

Insulation Tester

Instrument for insulation testing includes a voltage regulator tube to insure error due to line voltage fluctuations. It has a vacuum tube voltmeter on all ranges with an input resistance of 16 megohms maximum, a V. T. ohmmeter with seven ranges to 1,000 megohms, and a capacity meter measuring as low as 25 micromicrofarads and up to 2,000 microfarads.

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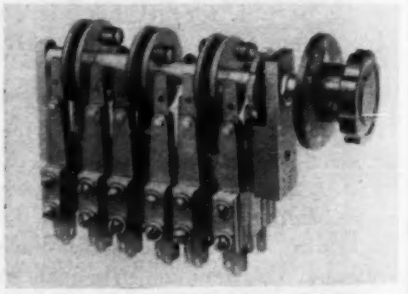


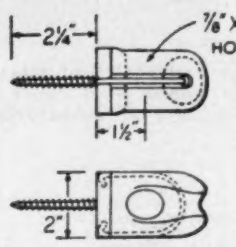
Rotary cam lever switch: rated 10 amp., 125 volts, a.c. **General Control Co.**, 1200 Soldiers Field Road, Boston 34, Mass.

Switch

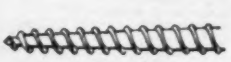
Designed for one to six index positions, new rotary cam lever switch provides circular cams for locating up to 12 low-friction, spring type actuators. It has cast aluminum frame, Bakelite cams and rollers, static shielding, nickel plated phosphor bronze contact springs and solid silver contacts. Any combination of spring leaf contact assemblies are available for each of the six positions. A single control knob will open or close a number of circuits in sequence or repeat.

BUYING ELECTRICAL EQUIPMENT?— ***McGraw-Hill's Electrical Buyers Reference*** **is a convenient place to look first for manufacturers' product data, names and addresses.**

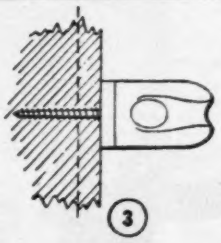
HUBBARD 4-11-44 WIREHOLDERS



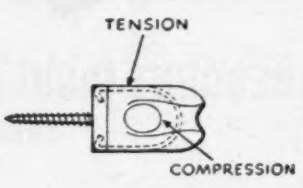
(1) Two Views of Hubbard 4-11-44 at 90° Turn



(2) Special Screw



(3) Full Thread



(4) Cut-away Section

1 Two diagrams of the Hubbard 4-11-44 Wireholder showing its sturdy construction. Tests on these wireholders, dead-end pull, have far surpassed recommended ratings on standard house service conductors. This is true of the wireholder itself. To insure maximum strength of an installation, a solid mounting is necessary. Attachment to sheeting so thin as to engage only a small portion of the screw (as shown by dotted line in Fig. 3) naturally reduces the holding power of the installation as a whole, no matter what the strength of the wireholder may be. This should be avoided.

2 Not an ordinary wood screw, but specially designed with a sharp point and a small root diameter near the point to allow easy starting. A light pressure is sufficient to start the screw in wood.

3 Full threaded screw, so that unavoidable installations on thin material are not caused to be excessively weak by lack of threads near the base. (See dotted line showing how installation on thin wood will not develop full strength of wireholder owing to reduced holding area of screw threads.)

4 A "tried and true" Hubbard Wireholder principle of thirty years success. Metal parts in tension — Porcelain parts in compression under load.

HUBBARD AND COMPANY

Pittsburgh
Chicago

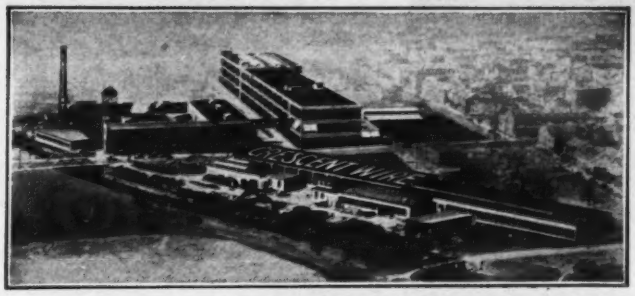
Oakland
California

• IMPERIAL NEOPRENE JACKETED PORTABLE CABLES •

THE

CRESCENT

NATION WIDE ORGANIZATION



originating at this factory at Trenton, N. J., serves the nation from coast to coast. Wherever you are located, these Representatives stand ready to assist you:

E. R. Blyler
A. Lee Clifford
R. H. Cupples
Crescent Electric Sales Co.
Crescent Insulated Wire & Cable Co.
Edgar E. Dawes
Leigh A. Doxsee Co.

Electric Agencies
Electrical Sales Co.
Paul Hogan, Jr.

W. F. Howe & Co.
Hemphill & Co.
Henger-Fairfield Co.
Henger-Fairfield Co.
C. A. Maley
J. T. Heagarty
M. C. Huie Co.
Kearton & Nagle
Ray Murphy
C. C. Pierce
J. T. Rodriguez

The Bourse Building
32 E. Georgia St.
324 First St. North
624 W. Adams St.

298 Duquesne Way
312 Rhodes Building
Rm. 307, 4030 Chouteau Ave.
562 First Ave. South
111 Cheapside St.
305 Levert Bldg.
823 Perdido St.
2627 McGee St.
446 E. Woodbridge St.
1810 Columbus Road

916 U. B. Building
Central Nat'l Bank Bldg.
707 Thomas Building
40 West 40th St.
720 East Second St.
241 Purchase St.
6 O'Donell St.

Philadelphia, Pa.
*Indianapolis 4, Ind.
*Minneapolis, Minn.
*Chicago 6, Illinois

*Pittsburgh, Pa.
Atlanta, Ga.

St. Louis, Mo.
Seattle, Washington
Baltimore 2, Md.

New Orleans 12, La.
Kansas City, Mo.
*Detroit 26, Mich.
*Cleveland, Ohio

Dayton, Ohio
Richmond, Va.
Dallas, Texas
New York City 18, N. Y.
*Los Angeles 54, Cal
*Boston 10, Mass.
San Juan, P. R.
*Warehouse

CRESCENT INSULATED WIRE & CABLE CO.

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CRESCENT

WIRE and CABLE

• RUBBER POWER CABLES • VARNISHED CAMBRIC CABLES •

ARMORED CABLE • CRESFLEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE CABLE • BUILDING WIRE

PERMACORD • LEAD-ENCASED AND PARKWAY CABLES • SYNTHOL WIRES • WELDING CABLES • SHIPBOARD CABLES

TECHNICAL LITERATURE

Metaplating—Metal plating on plastics, general properties of metaplate, preparation for plating process, surfaces, application, equipment, basis on which royalties are computed, are some of the subjects covered in a 16-page booklet. "The Metaplast Process and Licensee Plan" issued by Metaplast Company, 205 West 19th St., New York 11, N. Y.

Blow-off Systems—Heat saving that can be accomplished, the advantages from the standpoint of regulating boiler concentrations, the type of equipment available for different heat balance requirements, are explained and illustrated in Bulletin 4081. "Continuous Blow-Off Systems," available from Cochrane Corporation, 17th St. and Allegheny Ave., Philadelphia 32, Pa.

Industrial Trucks—New instruction manual entitled "Lady, Will You Give a Lift?" has been issued to train women in the operation of power industrial trucks. It explains to the new operator the importance of her job and tells in non-technical language how to operate her truck and to take care of it. The pocket-size booklet is obtainable from Elwell-Parker Electric Co., Cleveland, Ohio.

"Line Clearing Manual for Overhead Electric Conductor," publication K-10, 26 pages, illustrated. Price 35 cents. Edison Electric Institute, 420 Lexington Ave., New York 17, N. Y. Manual contains information suitable and in form to serve as a guide for managers, superintendents, engineers and others who are concerned with line design, construction, maintenance and operation.

Standards—"Coordination of Electrical Graphical Symbols," American War Standard, No. Z32.11-1944. Price 10 cents. American Standards Association, 29 West 39th St., New York 18, N. Y. Graphical symbols for electrical and electronic equipment, namely, capacitor, contact, resistor, inductor, transformer and operating coil, have been unified into a consistent set of symbols that will mean the same thing to everyone who uses them.

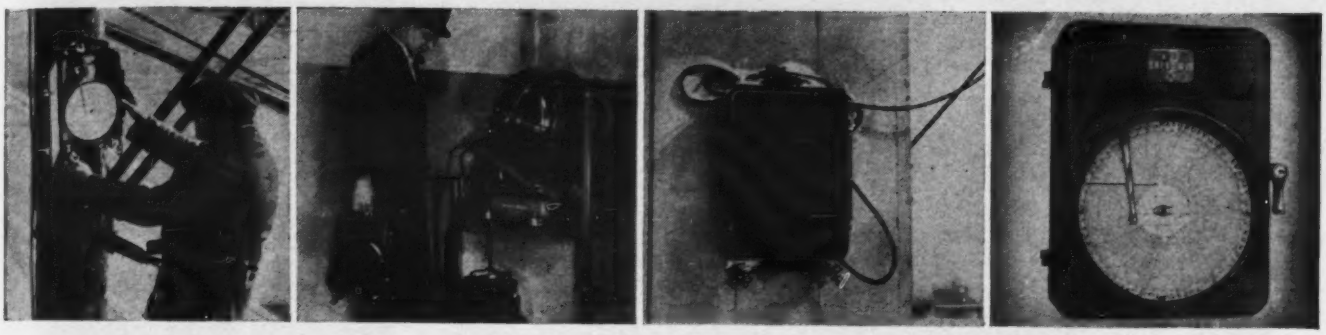
Electroplating—Jernstedt electroplating computer is a circular slide rule designed to compute chemical additions required in a plating bath, lists various cathode efficiencies, indicates thickness of deposit for plating time and current density, indicates weight of metal deposited, and other information for the plates. Computer made of synthetic resin is available from Hanson-VanWinkle-Manning Co., Matawan, N. J.; price $7.50 each.

"A Safety Color Code for Industry" is a 16-page booklet proposing a uniform system of color signals as suggested standards to indicate accident hazards, identify protective equipment and assure orderly arrangement and good housekeeping. Six colors have been selected—yellow, orange, green, red, blue and white (and black or gray). The booklet contains numerous illustrations in color and is available from E. I. duPont de Nemours & Co., Finish Division, Wilmington 98, Del.

Waxes—Specifications for 36 different kinds of waxes are contained in a bulletin, "Waxes for Today and Tomorrow," available from Distributing & Trading Co., 444 Madison Ave., New York 22, N. Y.

ALL-PURPOSE PORTABLE RECORDERS

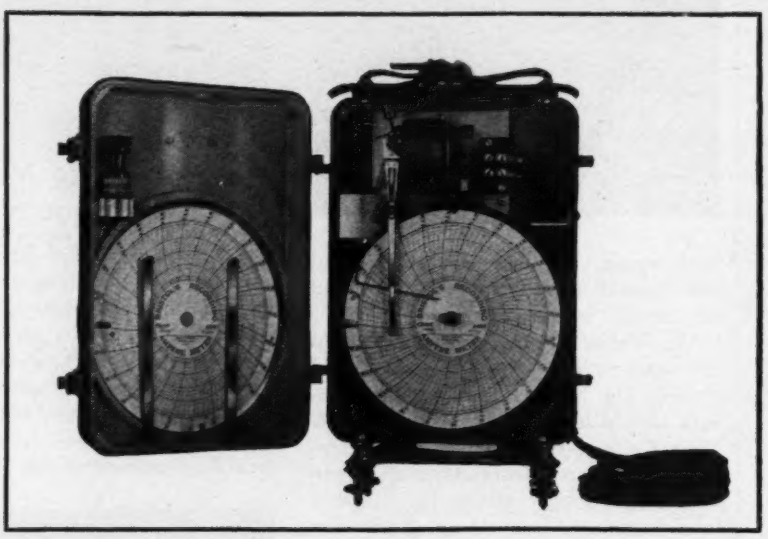
will help you keep a finger on voltage



Your men can mount a Bristol All-Purpose Portable Voltmeter on a pole . . . carry it into a cellar or down a manhole . . . set it on a floor or table . . . or mount it outdoors on a building. It's light and easy to carry . . . has a weatherproof case . . . and is rugged enough to take the wear and tear of constant handling without any interference with accuracy.

Features: 17 lbs. . . . replaceable measuring element . . . pen arm pivoted at top, pen pressure gravity-controlled . . . fine bore platinum tip fountain pen . . . integral resistors.

Complete information in Bulletin E1100.



THREE MODELS

One-Pen Inexpensive voltmeter for quickly analyzing conditions, investigating complaints, making voltage surveys, general testing, etc.

Two-Pen Records two different voltages simultaneously on one chart. Used for checking balance on three-wire systems and to study voltage drop in a section of a circuit.

Three-Pen Records three different voltages simultaneously on one chart. Used for investigating conditions in polyphase networks, for determining voltages at load centers and at ends of feeders.

THE BRISTOL COMPANY, 116 Bristol Road
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The Bristol Co. of Canada, Ltd.
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MAKERS OF

Metameters, Recording Voltmeters, Ammeters, Wattmeters, Thermoverters, and a broad line of Automatic Controlling and Recording Instruments.

NEWS ABOUT PEOPLE

Wisconsin Utility Elects Walter Vice-President

Roscoe G. Walter, who was elected vice-president in charge of operations of the Wisconsin Power & Light Co. (ELECTRICAL WORLD, May 27, page 93), was formerly supervisor of production,

engineering, system operation and maintenance of transmission lines and substations for the company.

Mr. Walter was resident engineer on the construction of the Kilbourn and Prairie Du Sac hydro-electric plants, both owned by the Wisconsin Power & Light Co. as a member of Mead & Seastone, engineers. He investigated Madison's water supply system in 1915 and later supervised rebuilding of the city pumping station.

It was in 1919 that he became associated with the power company and has been employed in the Madison office in connection with supervising production, engineering and system operation.

•

► DR. EDWIN H. ARMSTRONG, professor of electrical engineering at Columbia University and inventor of frequency modulation in radio reception, has been given the first chief signal officer's certificate of appreciation, awarded by the War Department. The award was established to honor civilians who have made extraordinary contributions to the war, but who are not eligible for awards made to civilian employees of the War Department or for the Army-Navy E. Nine other individuals or companies received awarded certificates, but the War Department designated the first one for Dr. Armstrong.

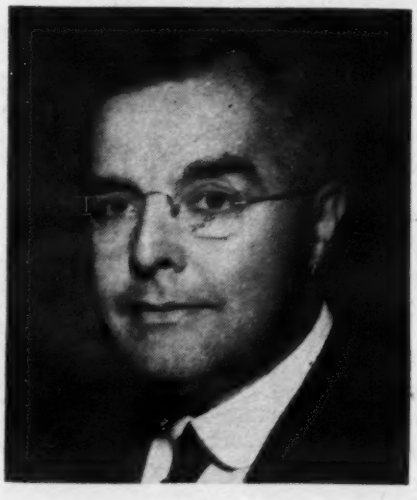
► HERBERT H. WEBB, assistant to the general manager of the Dayton (Ohio) Power & Light Co. since 1936, has been named sales manager for the American Felt Co., Detroit. Mr. Webb has been associated with the Dayton utility since 1929, going there from Cleveland where he was an electrical engineer for three years for the General Electric Co. When he first became associated with the Dayton company, he was in charge of lighting sales. Mr. Webb is a member of the Illuminating Engineering Society.

•

MacNeill Made Manager of Switchgear Division

J. B. MacNeill has been appointed manager of the switchgear and control division of the Westinghouse Electric & Manufacturing Co., succeeding R. A. Neal, whose election as a vice-president was recently announced (ELECTRICAL WORLD, May 13, page 146).

Mr. MacNeill has been associated with Westinghouse since 1909 with the exception of several years during which he studied electrical engineering at Massachusetts Institute of Technology. Upon receiving his degree in 1913 he returned to the company and has been successively engineer, section engineer, manager of the circuit breaker engineering department, general manager of distribution engineering and manager of switchgear engineering.



Patents have been issued to Mr. MacNeill, covering 30 electrical switching developments and several more are pending. In 1938 he received the Westinghouse Order of Merit.

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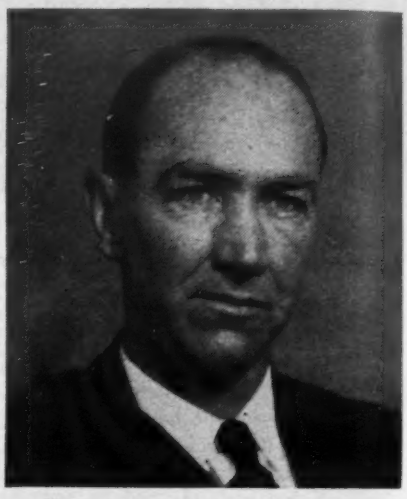
Minnesota Power Elects Pulver Vice-President

R. F. Pulver, general sales manager of the Minnesota Power & Light Co., Duluth, was recently elected vice-presi-



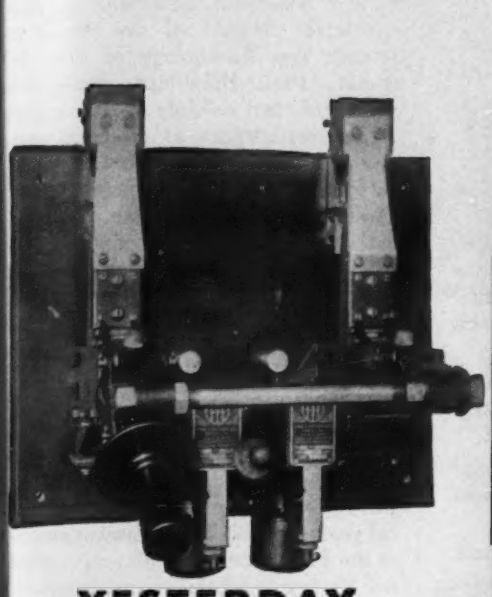
dent of the company. Mr. Pulver will continue to head the company's sales organization with the title of vice-president and general sales manager, it was stated.

Mr. Pulver joined the Minnesota utility in 1924 and has occupied various positions in the general sales department. He became general sales manager in 1941.

•

► EDWIN FLEISCHMANN has joined the staff of the research department of Gilbert Associates, Inc., Engineers and Consultants, as consultant. Mr. Fleischmann has been with Office of War Utilities, War Production Board, since 1942, as chief of the emergency curtailment unit and, since OWU was set up, as deputy chief of the fuel and allocations branch. For 15 years prior to his work in Washington, Mr. Fleischmann was with the Niagara-Hudson System in Buffalo and Niagara Falls in various operating administra-

WOULD YOU GO BACK?



YESTERDAY

TODAY

(Photos courtesy G-T-E Circuit Breaker Co.)

Tomorrow!

The design engineer of 1911 worked wonders with the limited materials at his disposal . . . yet few of us would want to go back to 1911 models. C-D DILECTO, a laminated phenolic plastic, was first made in 1911, when it was introduced as a "waterproof" type of vulcanized fibre. Today C-D DILECTO is available in many different grades . . . each engineered to meet specific electrical insulating problems.

C-D Laboratory Research is continuous and tomorrow will be producing new electrical insulating materials to meet the ever more exacting demands of electrical engineers. If experimental work will assist you in your post-war plans . . . write us today.

W-44

DILECTO

laminated phenolic electrical insulation

NEMA standards exist for the regular grades of laminated phenolics. These standards provide sufficient design data for the normal electrical insulating requirement. Where special problems are encountered, such as excessive moisture, high or low temperatures, U-H-F, arc tracking; the C-D Laboratory Staff of trained technicians will study your problem and if necessary develop a special grade of DILECTO to meet it.

Through special manufacturing methods, and Laboratory control, the properties of regular grades of DILECTO can be changed to meet special problems. For example, the C-D specifications for special DILECTO XPLW require the following properties as compared to NEMA standards for XXXP—both "low loss" grades of DILECTO.

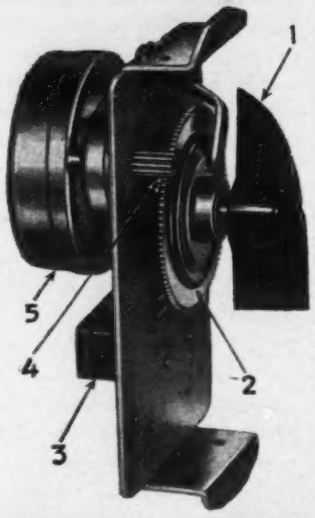
	⅛" THICKNESS	
	C-D Control Standards	NEMA Standards
Tensile Strength lbs. per sq. in. . .	10,000	5,000
Flexural Strength lbs. per sq. in. . .	20,000	12,000
Compressive Strength lbs. per sq. in. . .	30,000	25,000
Water Absorption, 24 hrs., percent .	.75	.85
Dielectric Str., Short Time, volts per mil	600	360
Power Factor— 1000 Kc	.026	.030
Dielectric Constant .	4.00	5.20

DILECTO catalog DO 43 gives complete data on regular and special grades, provides design suggestions, and information on standard sizes of sheets, rods and tubes. Send for your copy today.

Continental-Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911—NEWARK 15 • DELAWARE

Another Paragon Timer achievement!



Here's a notable development in automatic electric timers . . . which includes several distinct engineering and operating improvements.

ENGINEERING FEATURES

1 The setting knob is directly connected thru the switch operating cam; unit does *not* set thru a clutch; this provides positive switch action.

2 All energy required to operate switch itself is built up by manually setting pointer. Motor and clutch thereby relieved of all drag.

3 Switch—single pole, double throw, 1000 watt capacity, fully enclosed. Underwriter's approved.

4 Only 2 exposed gears—motor pinion and wheel. Precision hobbed.

5 Motor—self starting, slow speed, industrial type synchronous, completely sealed.

6 No energy is required of clock motor to trip switch at end of present time.

7 Nine time ranges from 0 to 14¼ seconds through 0 to 9¼ hours. Available in all types of enclosures.

8 All parts rust proofed and protected against corrosion.

2400 Series
For flush mounting

2900 Series
Wall mounting

2500 Series
Enclosed type

2500 Series
Side view
Mounts on handy boxes

NUMEROUS APPLICATIONS

Adaptable to any manually preset application with automatic switch operation at end of time cycle, such as plastic molding, rubber curing, batch mixing, heat treating, enamel baking, liquid agitation, light exposure—photographic, therapeutic, blue printing, infra-red drying,—blower operation, pump operation, conveyor operation and food processing.

PRECISION BUILT: This and every other Paragon unit is precision built, simple, accurate, reliable, modern and reasonably priced. Made by an organization of designers and engineers, growing since 1905.

SEND FOR BULLETIN . . . *containing complete construction and installation data.*

PARAGON ELECTRIC COMPANY
703 OLD COLONY BLDG. • CHICAGO 5, ILL.

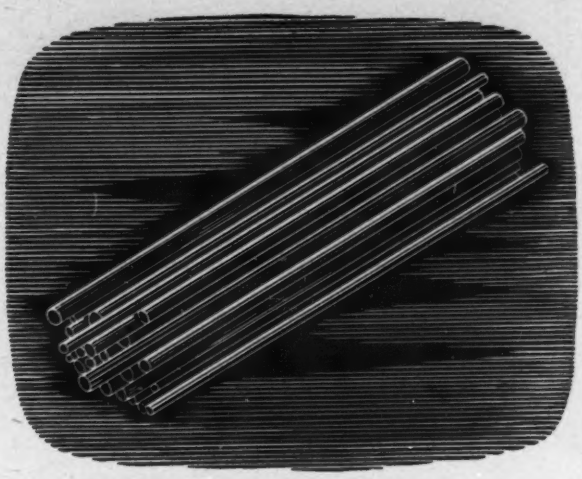
Paragon *Chicago*
BUILDERS OF ELECTRICAL EQUIPMENT SINCE 1905

tive and engineering positions—industrial heating engineer, manager of the new business and service departments, and later assistant to the president of Niagara Electric Service Corp., vice-president in charge of operation of Niagara Gorge Railroad Co. and Niagara Gray Bus Line, Inc. From 1936 to 1942 Mr. Fleischmann was particularly engaged in special engineering analysis of rates, contracts, operating expense problems and depreciation.

▶ PROF. NELSON S. HIBSHMAN has been appointed director of the School of Science and Technology of Pratt Institute. Prof. Hibshman, whose new office will start on July 1, is now head of the department of electrical engineering at New York University. A graduate of Pennsylvania State College, Professor Hibshman began his teaching career in 1924 at Lehigh University, becoming successively assistant professor and associate professor of electrical engineering at Lehigh. He joined the staff or New York University in 1942 as head of the electrical department. He was a vice-president of American Institute of Electrical Engineers for the term 1941-42. Prof. Hibshman's predecessor ARTHUR L. COOK, will retire at the close of the present fiscal year, June 30. He has been a member of the Pratt faculty for 35 years, including 25 years as head of the department of electrical engineering and six years as director of the engineering school.

▶ FRED D. WEBER, chief electrical engineer for the Oregon Insurance Rating Bureau, Portland, retired May 15 closing a 40-year career in the electrical industry. A graduate of the University of California, Mr. Weber started as a salesman with Allis-Chalmers in 1906 and left the succeeding year to join the Oregon Insurance Rating Bureau. He was secretary of the Northwest Section, International Association of Electrical Inspectors, since its inception in 1925 and one of the organizers of the Professional Engineers of Oregon. He also served on the examining board of the state of Oregon for 20 years, resigning in 1940. Mr. Weber is a member of the American Institute of Electrical Engineers.

▶ ROY A. WEHE, formerly gas and electrical engineer for the California Railroad Commission, has been appointed assistant director of public utilities for the Commission. Mr. Wehe's duties will include planning and conducting major formal and informal rate investigations of gas, electric, telephone, telegraph and water companies. Prior to joining the Commission in 1923, Mr. Wehe was employed on hydro-electric projects of the Southern California Edison Co. He is



CONDENSER TUBE

EVAPORATOR TUBE

HEAT EXCHANGER TUBE

WOLVERINE
TUBE DIVISION

CALUMET & HECLA CONSOLIDATED COPPER COMPANY

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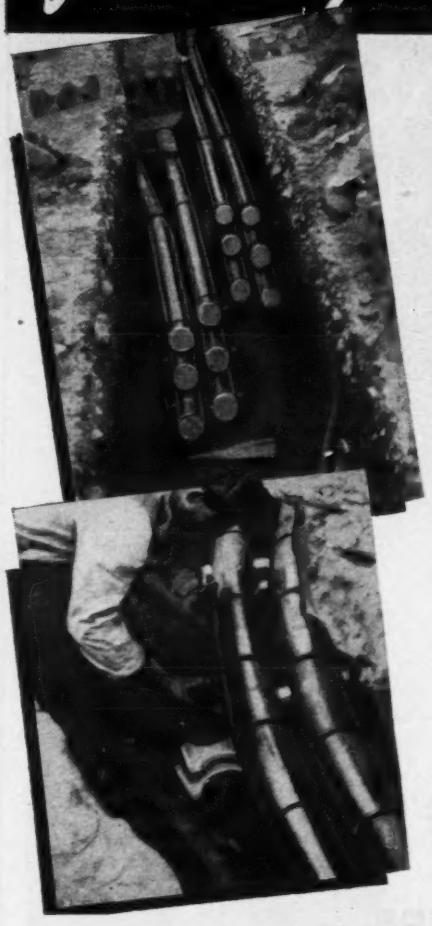
In Canada: UNIFIN TUBE CO., LONDON, ONT.

CABLE PROTECTION... *from Beginning to End*



The low coefficient of friction of ORANGEBURG duct keeps pulling tension to a minimum. And its smooth surface does not score or damage the cable sheath.

Moreover, the coal tar pitch and cellulose fibre in ORANGEBURG contain no chemicals to attack cable sheath. The duct's impermeable walls and tight joints assure additional protection to cable sheath by preventing the entry of harmful ground waters or chemicals.

ORANGEBURG duct materials are non-corrodible, too. Being non-metallic, they are not subject to electrolytic attack—do not carry stray currents — are not corroded by chemical wastes often present in ground waters. ORANGEBURG stays on the job.

ORANGEBURG is easy to install, and the taper sleeve coupling assembles speedily to produce a watertight joint without the use of compounds. Light in weight, easy to handle, easy to saw. Joints easily, quickly made on the job. Angle couplings and other standard fittings make it easier to cope with the unexpected conditions that always crop up during construction.

For these and other reasons, ORANGEBURG is economical—low in first cost, low in ultimate cost, as proved by over 50 years' service in the underground protection of electrical cables. Write for literature today!

7 Good Reasons for Specifying
ORANGEBURG FIBRE CONDUITS

1. LESS CABLE PULLING TENSION
2. NO CABLE SHEATH ABRASION
3. NO GROUND WATER INFILTRATION
4. PERMANENT—NON-CORRODIBLE—NON-CORROSIVE
5. ECONOMY OF INSTALLATION
6. EASE OF INSTALLATION
7. SERVICE FITTINGS

THE FIBRE CONDUIT COMPANY • ORANGEBURG, N. Y.
GENERAL ELECTRIC SUPPLY CORP. *Distributors* GRAYBAR ELECTRIC CO., INC.

ORANGEBURG FIBRE CONDUIT

THE FIBRE CONDUIT CO. ORANGEBURG N.Y.

ORANGEBURG

WITH 50 YEARS EXPERIENCE IN THE MANUFACTURE OF NON-METALLIC CONDUIT AND PIPE, SERVES THE POWER AND LIGHT, TELEPHONE, GENERAL CONSTRUCTION, CHEMICAL, PETROLEUM, PLUMBING AND BUILDING SUPPLY FIELDS WITH ELECTRICAL FIBRE CONDUIT . . . ELECTRICAL UNDERFLOOR DUCT SYSTEMS . . . AND FIBRE PIPE FOR NON-PRESSURE USES.

graduate in electrical engineering from the University of North Dakota and studied two years at the Massachusetts Institute of Technology.

► WILLIAM L. ABBOTT, retired chief operating engineer of the Commonwealth Edison Co., Chicago, was made an honorary member of the Chicago Engineers Club on May 23. Dean M. L. Enger, college of engineering, University of Illinois, represented the University at the dinner held in Mr. Abbott's honor. A graduate of the University of Illinois, Mr. Abbott served 14 years as president of the board of trustees. The University's new power plant, erected three years ago, was named in his honor.

•

Westinghouse Announces New Appointments

Several new assignments have recently been made by the Westinghouse Electric & Manufacturing Co.

W. F. Boyle, who has been with the company's steam division and the Middle Atlantic sales district since 1927, has been appointed manager of gas turbine activities at the steam division in Philadelphia. Prior to his new assignment, he was manager of the marine section of the steam division application department.

R. C. Brannan has been made manager of the transformer equipments section of the transformer division at Sharon, Pa. Immediately prior to his present appointment, Mr. Brannan was a headquarters commercial engineer in the power transformer section of the transformer division.

Frank R. Benedict has been made head of the newly created product performance analysis section at the East Pittsburgh plant. The new section will "follow through" on installations of Westinghouse steam turbines, generators, motors, transformers, switchgear and other equipment to make certain that performance meets requirements. Mr. Benedict became associated with the company in 1928. From 1936 to 1938 he was engineer in charge of the Trafford laboratories and the Impulse Laboratory at East Pittsburgh. Then he was made liaison engineer on the chief engineer's staff and was assigned to quality control studies on Westinghouse apparatus. Early in 1940 he was transferred to the district engineering and service department as a consulting and application engineer. A year later he was made manager of engineering and service in the New England area.

Andrew G. Nelsen has been made manager of the Middle Western district Westinghouse Lamp Division. Mr. Nelsen is a director of the Chicago Light-

Plan STREET LIGHTING Now . . .

For Safe, Peace-Time Traffic . . .

To be efficient, Street Lighting must be planned . . . The details of traffic flow, unusual or hazardous sections, expected changes in future traveling methods —all must receive careful study . . . And after proper analysis the complete plan for your locality and individual conditions should be made by competent authorities.

Holophane Engineers offer you their aid—and the knowledge acquired from years of concentrated experience . . . They will tell you about the new light patterns, new methods and will make recommendations that will assure the most satisfactory street illumination for your community. Their services are available without charge . . . Write for engineering data.

HOLOPHANE COMPANY, INC. . . . *Lighting Authorities Since 1898*

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New Air Tool Drives "blind" Rivets Accurately... Automatically

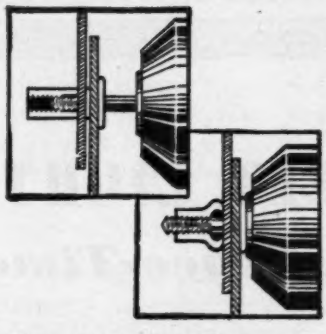
Installing "blind" RIVNUTS quickly with precise, positive upset while working entirely from one side is now possible with the recently developed Auto RIV-Driver. Completely automatic, the tool runs a threaded mandrel into a Rivnut, upsets it, backs the mandrel out and stops the tool. Operators simply press a throttle; make no manual adjustments for any operation. Rivnuts are installed 6 to 8 times faster than formerly; rejects are almost completely eliminated.

The tool can be adjusted to upset at any depth required. Once set, adjustment is tamper-proof—every Rivnut is driven accurately and uniformly. An indicator on the tool handle lights when the upset is correct; does not light if Rivnut is improperly headed.

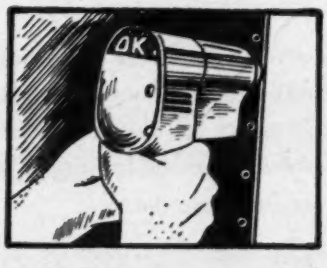
Powered by compressed air, the Auto RIV-Driver weighs just 4¼ pounds; is 9½ inches long; balanced for efficient handling by women operators.

You all know that our fighting men need the finest quality materials that we here at home can produce. That goes for Wrigley's Spearmint, Doublemint and "Juicy Fruit" chewing gum, too. Our stock pile of raw materials that goes into the making of Quality chewing gum is getting lower and lower. Until we can again build up our raw material inventory, we are sending all of our limited output of Quality chewing gum to our fighting men and women overseas, only.

You can get complete information from the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago 6, Ill.



Rivnuts (mfd. by B. F. Goodrich Co.) are internally-threaded tubular rivets which can be installed "blind" while working entirely from one side of the job.



Automatic action, positive depth control and visual indicator assure correct and uniform installation of rivnuts with new Auto RIV-Driver.

Y-119

ing Institute and a member of the Illuminating Engineering Society.

Richard B. Borland, for the past 14 years an application engineer for the Westinghouse Lamp Division at Los Angeles, Calif., has been made manager of the division's Los Angeles office.

Russell L. Whitney, formerly sales manager of the transformer division of the Westinghouse Electric & Manufacturing Co., at Sharon, Pa., has been appointed manager, agency and specialties division, central district. Mr. Whitney succeeds H. E. Bracke, who has been named to a new position with the Westinghouse Electric Supply Co. in Detroit.

William W. Sproul, Jr., has been appointed manager of the application department of the Sharon Works. He has been with Westinghouse since 1927.

•

R. A. McCarty on Leave to Do Government Work

R. A. McCarty, vice-president of the Westinghouse Electric & Manufacturing Co. in charge of its subcontracting activities, has been granted a leave of absence to assume an executive position in Washington with the Smaller War Plants Corporation. The Westinghouse headquarters subcontracting department has been brought under the direction of Andrew H. Phelps, vice-president, who is in charge of purchases and traffic for the company.

Mr. McCarty was granted the leave at the request of the government. His experience in guiding Westinghouse subcontracts and the knowledge gained during 40 years spent as an engineer and executive in the company's manufacturing operations give him particular qualifications for the government assignment. Mr. McCarty's new position is special assistant to Maury Maverick, chairman and general manager of the corporation.

•

▶ WILBUR B. DRIVER, formerly president of the Wilbur B. Driver Co., Newark, N. J., has been elected chairman of the board and ROBERT O. DRIVER, his son, has succeeded him as president. In a statement issued announcing his retirement as president, Mr. Driver said: "From nothing, we have grown in 25 years to our present position . . . It would be foolish to say we are satisfied with our accomplishments, but we believe we have done somethings worthwhile, and we are continuing to strive . . ." Robert O. Driver, the new president, has been connected with the company for ten years. The new set-up includes: WILLIAM J. WIND, vice-presi-

"a preventive is better than a cure"

Mica used where mica belongs saves the appliance dealer a lot of service call headaches.

When you think of MICA think of MACALLEN

the Macallen Company

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..They broke the production jam on these Armatures with EASY-FLO

THESE Armatures are part of small fractional horsepower motors used in aircraft to the extent of hundreds of thousands. Obviously, fast production was vital.

The armatures are held together by brass wires in the grooves of the steel laminations, fastened to the brass end plates. They started doing the fastening by soft soldering, but this proved unsatisfactory.

Then EASY-FLO was tried and, as on hundreds of other war production jobs, this low-temperature free-flowing, fast-acting silver brazing alloy did the trick. Important factors in obtaining the required high production were (1) **preplacing** the alloy in the form of EASY-FLO wire rings as shown, and (2) using a **fast heating** method—in this case induction heating. With this combination a number of armatures are brazed simultaneously in approximately 10 seconds.

GET SET FOR STIFF COMPETITION AHEAD

Start getting the benefit of EASY-FLO's exceptional brazing speed, reliability and economy on your own metal joining. These advantages are going to make EASY-FLO brazing a big factor in the keen competition of peacetime operations. **BULLETIN 12-A** will give you full details about EASY-FLO and how to put it to work in your plant. Write for your copy—now.

ARMY E NAVY

HANDY & HARMAN

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Agents in Principal Cities

dent in charge of production, who has been with the company from the start and for years has directed manufacture; SIDNEY A. WOOD, vice-president in charge of sales, who has been associated with the company since 1929, for the past 12 years as sales manager and KARL R. TALLAU, secretary and treasurer, who has been identified with the organization since 1936, until now as auditor.

•

Frigidaire Appoints New Sales Executives

Announcement has been made of the appointment of Harry M. Kelley to the position of appliance sales manager of Frigidaire Division, General Motors Corp., and the return of Paul H. Brennan to his former position of commercial sales manager.

Mr. Kelley has served in various important sales capacities in his 12

H. M. Kelley

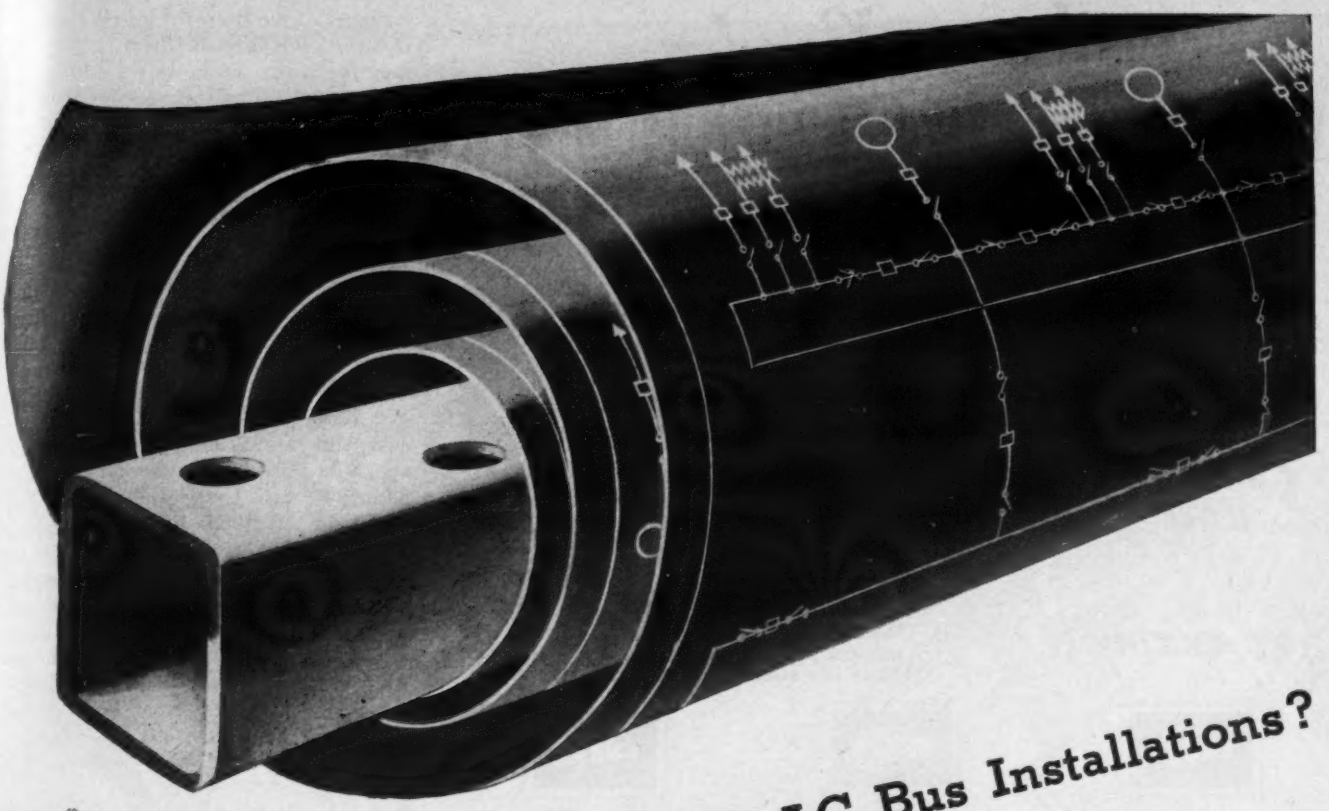
years at Frigidaire. He was district sales manager for four years before going to the factory as a specialist in the public utility sales division. Later he became sales manager of special markets, which included farm, replacement, and multiple housing sales. In his new capacity as appliance sales manager, he has charge of all household appliance product sales.

Mr. Brennan has been associated with the Frigidaire commercial sales division for more than 17 years.

Until assuming their present positions, both Mr. Kelley and Mr. Brennan had important responsibilities in Frigidaire's war contracts division.

•

► A. E. RHOADS has been elected executive vice-president and general manager of the Kuhlman Electric Co., Bay City, Mich. Since 1938, Mr. Rhoads has been



Planning New AC Bus Installations?

CHASE VENTILATED BUS CONDUCTOR

Now is the time to investigate the advantages of Chase Ventilated Square Tube.

Its high current capacity, for example . . . ventilated holes provide cooling by natural convection. Exceptional rigidity . . . no need for auxiliary clamping devices. And—note this—maximum mechanical strength in all directions.

You will want all the facts on these copper-conserving features when you plan AC bus installations.

For full details on Ventilated Square Tube, as well as on other bus conductor forms, write for the Chase Electrical Handbook.

Time-Saving Service

Bus conductor calculations keeping you swamped? Chase engineers will be glad to advise with you on the most economical size and shape of bus conductors for your requirements.

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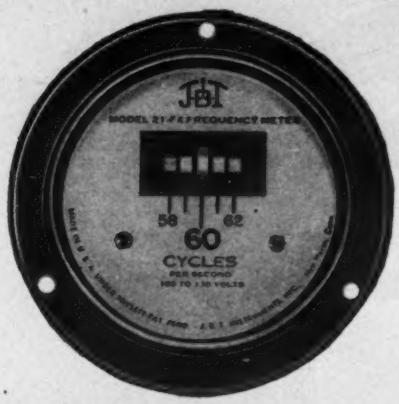
This is the Chase Network—handiest way to buy brass

How to Read a VIBRATING REED FREQUENCY METER in 1 Easy Lesson!



ON THE NOSE! Model 21-FX, full cycle increment, shown indicating a frequency of 60 cycles. The 60 cycle reed is vibrating to full amplitude with the adjacent 59 and 61 cycle reeds practically at a stand still.

for example:

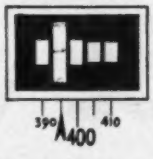
60.5 cycles. The 60 and 61 cycle reeds are vibrating *equally*, but to less than full amplitude. Side reeds are quiet.

60.75 cycles. The 60 cycle reed is vibrating a little, and the 61 cycle reed is vibrating to almost full amplitude. Other reeds are quiet.

60.75 cycles. Note this is a half-cycle instrument. The 60.5 and the 61 cycle reeds are vibrating equally.

24.85. Watch the scale! Each division is one half cycle. Frequency lies between 24.5 cycles and 25 cycles and closer to 25 than 24.5.

118.0. This one is easy. Each division represents a full cycle. The 118 cycle reed has no competition in this example.

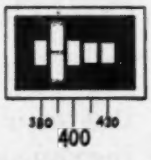


395. This is a cinch, too. How many cycles per division? Five—right. The 395 cycle reed has everything its own way, here.

Now, how good are you? Watch your Scales!

A

B



C

SIMPLY READ THE REED That's Your Frequency!

Bulletin VF-43 with supplements gives detailed descriptions of the complete line of J-B-T Frequency Meters. Your copy is waiting for you.

J-B-T

Answers, but NO PEEKING

A = 59.5
B = 390.0
C = 26.0

(Manufactured under Triplett Patents and/or Patents Pending)

J-B-T INSTRUMENTS, INC.

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manager of the Detroit Electric Furnace Division of Kuhlman. Prior to 1938 he was for many years vice-president in charge of sales and service for the Detroit Electric Furnace Co. before it became a division of Kuhlman.

OBITUARY

▶ LOUIS M. ROSSI, vice-president of Bakelite Corp., died on May 25 at the Medical Center, New York, following a sudden illness. He was 66 years old. When the Bakelite Company was formed by Dr. Leo H. Baekeland in 1910, Mr. Rossi was appointed works manager, and in 1919 he was made general manager. In 1923, after the consolidation of the General Bakelite Co., Redmanol Chemical Products Co. and the Condensite Co. of America into Bakelite Corp., Mr. Rossi was elected vice-president and director of manufacturing, the position he retained until his death. He was a member of the American Institute of Chemical Engineers, American Society of Testing Materials, Plastics Materials Manufacturers Association and other societies.

▶ ALFRED J. BOHL, 58, secretary and treasurer of Wisconsin Electric Power Co., Milwaukee and subsidiary companies, died on May 18, after an illness of several weeks. A veteran of 43 years of utility service, Mr. Bohl started with the Milwaukee company in July, 1901, as a messenger and rose through the ranks to become secretary and treasurer in February, 1941. Previously he was controller and assistant treasurer.

▶ THOMAS P. CURTIS, 72, vice-president of the Lord Electric Co., Boston, New York and Pittsburgh, died at a Boston hospital on May 28. He was born in San Francisco; was a graduate of the Massachusetts Institute of Technology, and after studying in Germany joined the Lord company about 50 years ago.

▶ JOHN J. O'CONNELL, 55, director of public relations of the Western Massachusetts Electric Co., and manager of its Pittsfield, Lee and Hampshire divisions, died suddenly on May 28 at his home in Pittsfield. He was born in Westgrove, Pa., and after five years in the electrical department of Worth Bros. Iron & Steel Co., Coatsville, Pa., became business representative of the Greenfield Electric Light & Power Co., at Northfield, Mass., and then at Deerfield and Shelburne Falls. Later he was manager and then vice-president of the Amherst Gas Co., which supplied central station service in that area. In 1931 he was transferred to Pittsfield, and in addition to many civil activities was responsible for the local utility management and the publicity affairs of the system's properties, including

POWER TO DESTROY THE AXIS

SMALL compared with the supreme sacrifices of the men on the fighting fronts on land and sea, the production accomplishments of men and machines in American industry have made their successes possible. Behind the production, and never too little or too late, is the gigantic massing of electric power—over 80 per cent of it supplied by business managed electric power companies.

Possible because of long range planning and teamwork in the American Way—teamwork that includes all of our employees from those on far-flung battle fronts to those with their hands on the switches that release the power to war industries. We will continue this support, for here in America we have *more electric power than the Axis Nations and all their satellites combined.*

American Gas & Electric Service Corporation

Principal Affiliates

Atlantic City Electric Company
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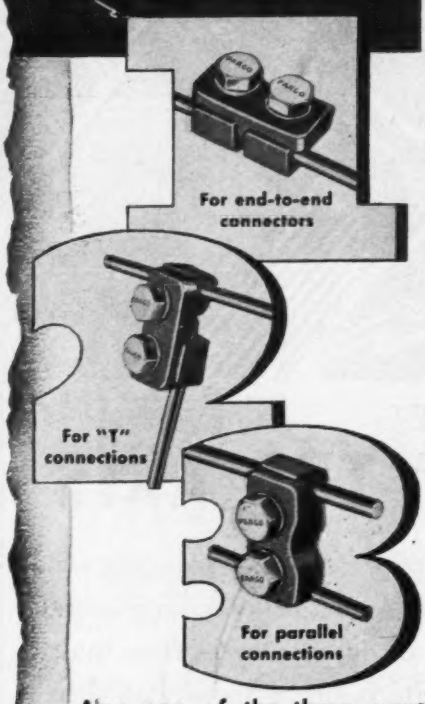
Indiana General Service Company
Indiana & Michigan Electric Company
Kentucky and West Virginia Power Company, Inc.
Kingsport Utilities, Incorporated
The Ohio Power Company
The Scranton Electric Company
Wheeling Electric Company

connect 3 ways with 1 connector

the FARGO "Du-All"



Any one of the three ways you use this Fargo "Du-All", you get a sure-gripping, high conductivity contact. To change it from one type of connector to another, simply loosen the clamping member and turn it to the desired position. High strength copper alloy bodies and Duronze bolts that last and last . . . available in a wide range of sizes especially adaptable for industrial and substation use.

Made by FARGO MFG. CO

Distributed by

LINE MATERIAL CO.

MILWAUKEE • WISCONSIN

Springfield and all the utilities later merged into the present Western Massachusetts company.

▶ ALBERT H. ARMSTRONG, retired General Electric Co. engineer widely known for his work in railroad electrification, died on May 31 in Schenectady after a long illness. He was 73 years of age. Mr. Armstrong entered the employ of the Thomson-Houston Electric Co., Lynn, Mass., in 1891 on the design of induction motors and alternating-current generators, and in 1892 when General Electric was organized through the merger of Thomson-Houston and Edison General Electric companies, he went to Schenectady to work on general a-c design under the direction of the late Dr. Charles P. Steinmetz. In 1894 Mr. Armstrong was transferred to the engineering department, and three years later joined the railway engineering department and from that time on devoted most of his time to the study of railway problems. He became assistant engineer of the G-E railway engineering department and in 1929 he was named consulting engineer of the transportation engineering department. He retired in 1930. Mr. Armstrong was a member of the American Institute of Electrical Engineers.

▶ CORNELIUS DONLAN, general commercial manager of the Westchester Lighting Co., Mt. Vernon, N. Y., and the Yonkers Electric Light & Power Co., died at his home in Mount Vernon on May 30 in his sixty-fourth year. Mr. Donlan became associated in 1907 with the Consolidated Gas Co. in New York, predecessor of Consolidated Edison, which owns the Westchester companies. He went to the Westchester companies in 1924 and three years later was made commercial manager. It was in 1937 that he was promoted to the position of general commercial manager.

▶ H. BURTON GAY, retired vice-president of the Electric Storage Battery Co., Philadelphia, died on May 18 in Miami, Fla., after an illness of two months. He was 73 years of age.

▶ JOHN R. MEEHAN, assistant to the president of the Phelps-Dodge Copper Products Corp., New York, died on June 1 in the Stamford Hospital, Stamford, Conn., at the age of 43. Mr. Meehan was born in Amesbury, Mass. His first employment was with the Delaware, Lackawanna & Western Railroad at Scranton, Pa. He next became divisional manager for the Central Hudson Gas & Electric Co. at Kingston, N. Y., and from there went to the Florida Power & Light Co., Miami. Subsequently he became identified with the Stamford Rolling Mills and several years ago joined the Phelps-Dodge Corp.

TREES

A problem in public relations . . . or just an insulating problem

PINCO tree insulators provide the answer

Costing less than a single tree trimming, a Pinco Tree Insulator pays for itself in a short time, not only in dollars and cents savings but also in the grief it saves the public relations department.

ALL PORCELAIN . . . Made entirely of Pinco High Test Porcelain it offers the insulating protection only porcelain can give and is unaffected by moisture or the abrasive action of rubbing branches.

EASILY INSTALLED . . . The Pinco Tree Insulator is easy to install. It needs only to be placed *on* the wire at the point of contact and secured at each end with tie-wires. Available in 12, 14 and 16 inch lengths. Where needed several units may be tied together. Write for complete information and prices.

Pinco Insulators are catalogued in the Electrical Buyers Reference

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LIMA, NEW YORK

PORCELAIN INSULATOR CORPORATION, LIMA, N. Y.
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Please send me complete information on Pinco Tree Insulators:

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TITLE.....

COMPANY.....

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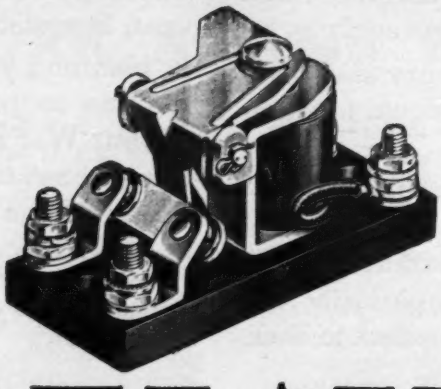
TYPES OF



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NEW YORK • PITTSBURGH • ST. LOUIS • SAN FRANCISCO • SEATTLE • SYRACUSE • TORONTO • WASHINGTON

Sound the Alert!

MANAGEMENT
LABOR

—for the 5th War Loan drive during June and July. The need for the 5th War Loan is immediate, crucial. For impending events may make the 5th the supreme financial effort of the war.

The U. S. Treasury has set the overall goal at $16,000,000,000 — $6,000,000,000 from individuals alone. This is the biggest sum ever asked of the American people—*and it must be raised.*

That's why the U. S. Treasury asks Management and Labor to sit down together and organize—NOW!

For organization—good organization—has been responsible for the excellent showing of the payroll market. And its most important single superiority has been personal solicitation—desk to desk, bench to bench, machine to machine personal solicitation. 71% of all persons on payroll deductions were solicited for the 4th War Loan.

Now, to personal solicitation, add the sales incentive of a definitely established plant quota. Build your campaign around a quota plan. Set up departmental goals. Stress percentage of participation figures. Stimulate group enthusiasm.

In planning your quota campaign, work in close cooperation with the Chairman of your War Finance Committee. Everything is set to make the 5th War Loan drive a huge success—with your help!

(Note: You've read this message. If it doesn't apply to you please see that it reaches the *one* person who can put it in action!)

Here's the Quota Plan:

1. Plant quotas are to be established on the basis of an *average* $100 *cash* (not maturity value) purchase per employee.
2. Regular Payroll Savings deductions made during the drive accounting period will be credited toward the plant quota.
3. 90% of the employees are expected to contribute toward raising the cash quota by buying extra 5th War Loan Bonds: 1—Outright by cash. 2—By extra installment deductions. 3—By extra installment deductions plus cash.

Example: **JOHN DOE Mfg. Co.** — 1,000 Employees

1,000 employees x $100 Regular Payroll deductions during the eight weekly payroll Accounting Periods of June and July = $100,000 Cash Quota

30,000
$70,000 (to be raised by sales of extra Bonds to at least 900 employees)

ORGANIZE • SOLICIT • DELIVER

The Treasury Department acknowledges with appreciation the publication of this message by

ELECTRICAL WORLD

★ ★ *This is an official U. S. Treasury advertisement—prepared under the auspices of Treasury Department and War Advertising Council.* ★ ★

NEW YORK MEANS BUSINESS

Today, and for the years ahead, the door is open wide for productive enterprise in the Empire State—where diversified industry spells opportunity. For the businessman who prepares now, rich rewards lie ahead.

War Is Our Business Until Victory

New York has produced more than one-tenth of the nation's war goods—with only a small proportion of government plant construction. A large part of war products vary but little from accustomed peacetime output. For these reasons, problems of reconversion will be easier in this State.

In New York you have at your doorstep nearly one-third of the nation's retail sales. Within the State, you have more than a quarter of the country's wholesale trade. You have an abundant supply of raw and semi-processed material.

You operate in the only State touching both the Atlantic Ocean and the Great Lakes—with 900 miles of navigable waterways connecting its unmatched port facilities.

You are strategically located on a well-established transportation network that has paced the growth of the leading industrial State.

New York State's 5,000,000 workers produce *more* per dollar of wages. Labor and management agree here—with profit to both. Witness New York's strike record in the war—fewer manhours lost due to strikes than any other industrial state in the Union.

When peace comes again, New York is ready to forge ahead. Whether you are located within or outside of the State, if you are making plans for business expansion, the Department of Commerce of New York State can help you.

Use These Services

We can assist you on plant locations; supply information on manpower and other significant factors; help you get a preview of taxes for your enterprise; give technical service on new materials and new products; help promote opportunities in foreign trade. These and many other services are available both through our offices throughout the State and through our contact with Chambers of Commerce and other local groups.

Just address M. P. Catherwood, Commissioner of Commerce, Albany 1, New York, and your request will receive immediate attention.

NEW YORK STATE

Department of Commerce

MANUFACTURING MARKETS

Predicts Huge Radio Demand by Year-End

A pent-up demand for between 20,000,000 and 25,000,000 radio receiving sets will exist by the end of 1944, as compared with the industry's all-time high production of 13,000,000 units in 1941, it was estimated by Larry E. Gubb, chairman of the board of directors of Philco Corp., in an address on "Electronics and Television in the Post-War World" before the Bond Club of Philadelphia.

"Today the radio-electronics industry is turning out specialized types of war equipment at the rate of approximately $3.2 billions a year—a greater volume of output than that of the entire automobile industry in 1939," Mr. Gubb said. "The present war has caused a great acceleration of research and development work in radio and the ultrahigh frequencies . . . It is still too early to foretell what revolutionary peacetime applications may result from these scientific advances." In addition to the normal replacement demand for radio sets, FM will become increasingly important in the post-war years, Mr. Gubb said. The greatest application of all for electronics is television, Mr. Gubb said, though he stated that the rate at which television will grow in the next few years is somewhat a matter of conjecture.

In concluding Mr. Gubb said:

"The radio-electronic industry should be extremely busy for some years to come catching up on deferred demands for radio sets, developing the great new market that FM is opening, and beginning to make television available to 135,000,000 Americans."

•

Electric Motors War Role Depicted

In a booklet, entitled "Skilled Men Make Electric Motors—Power for Mechanized War," issued jointly by the War Production Board and the National Electrical Manufacturers Association, an interesting summation of the contributions of electric motor manufacturers and their employees toward victory is given. The booklet emphasizes the manpower requirements to meet the nation's increasingly heavy demands for motors and generators.

Highlights include:

Production quadrupled since 1941, with 1944 needs still on the increase, despite cutbacks on some military programs.

Nearly 80 percent of all motors and generators go directly to armed services.

Demand for motors is approaching the industry's capacity to produce them.

•

Army-Navy "E" Awards

Announcement has been made that the Army-Navy "E" has been presented to the manufacturing and repair department plant of the Westinghouse Electric & Manufacturing Co. in Buffalo, N. Y. Price Brothers Co., manufacturers of relays and magnetic controls at Frederick, Md., has also received the "E" award. Other recent recipients include: Sangamo Electric, Springfield, Ill., third star; Sylvania Electric Products, Emporium (Pa.) plant, third star; Babcock & Wilcox Co., Barberton (Ohio) fourth renewal.

•

Appoint Copper Wire, Cable Committee

First meeting of the newly-organized Technical Copper Wire and Cable Industry Advisory Committee was held recently. E. H. Hammond, Jr., is government presiding officer.

Committee members include:

Alfred Bellis, John A. Roebling's Sons Co., Trenton; M. R. Cottrill, General Insulated Wire Works, Inc., Providence; A. D. Cummings, Collyer Insulated Wire Co., Pawtucket; Ernest W. Davis, Simplex Wire & Cable Co., Cambridge, Mass.; Frank E. Dresner, General Motors Corp., Warren, O.

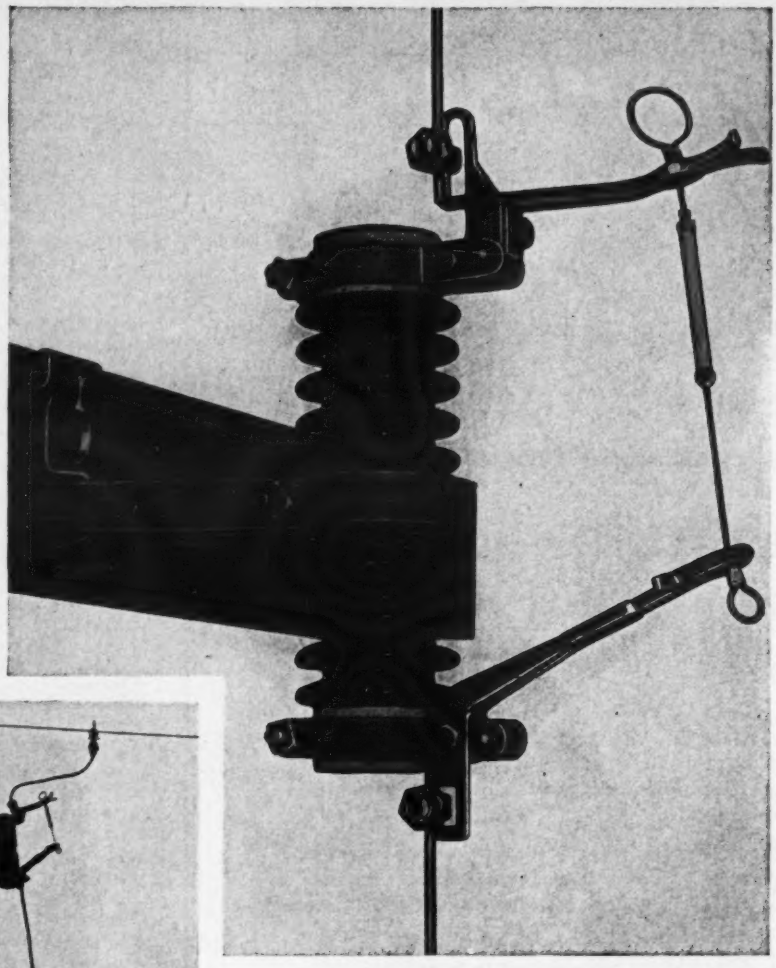
I. J. Furst, Circle Wire & Cable Corp., Maspeth, L. I.; Clifford O. Hull, General Electric Co., Bridgeport; John H. Ingmanson, the Whitney Blake Co., New Haven; R. W. Moore, National Electric Products Corp., New York; W. F. Osler, Jr., Cornish Wire Co., Inc., New York.

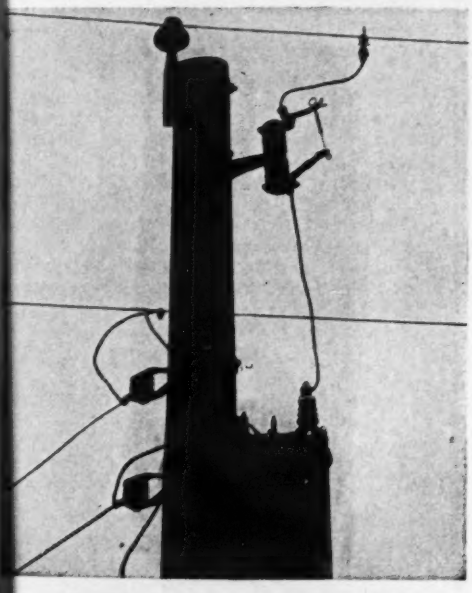
W. T. Peirce, American Steel & Wire

CHECK STEEL TEST—Women engineers who attended a nine-month intensive engineering course at Carnegie Institute of Technology sponsored by the Westinghouse Electric & Manufacturing Co., make a test on a steel rod as part of their final laboratory work at the school. They are among the 33 women who completed the training and who are being assigned to company engineering and research laboratories

Matthews Protectolink Cutouts Conserve Essential War Materials and Reduce Costs

Protectolinks Can Be Installed and Removed With Standard Ball Point Hot Stick





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It Gives Complete Information

Made in the Following Sizes

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Catalog 1639
50 Amperes
5000 Volts

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Catalog 1640
50 Amperes
7.5/12.5 Kv.
Grd. Y

• ● •

Catalog 1641
50 Amperes
15000 Volts

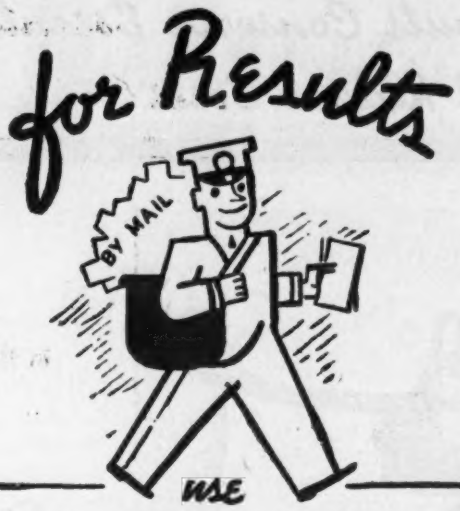
In this Wartime emergency, the problem of conserving materials which are essential to our Victory Program rests upon all of us. **MATTHEWS PROTECTOLINK CUTOUTS** use a minimum of copper and steel and the elimination of fuseholder tubes conserves fibre and bakelite; therefore they will help you to accomplish considerable savings in these materials and in addition show you dollar savings.

They are rugged in construction. Spring tensioned lower arm separates Protectolink instantly when short circuit or meltout occurs. Hooked lower arm and forked upper arm facilitates installation of Protectolink; these fuse links are designed so they cannot be installed upside down and will fit any make of open link cutout. Protectolink buttons fit snugly into cupshaped recesses in upper and lower contact arms, assuring positive and radio noise-proof contacts.

W. N. MATTHEWS CORPORATION

SAINT LOUIS, U. S. A.

ENGINEERS and MANUFACTURERS SINCE 1899



MAILING LISTS THAT WORK . . .

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Probably no other organization is as well equipped as McGraw-Hill to solve the complicated problem of list maintenance during this period of unparalleled changes in industrial personnel. These lists are compiled from exclusive sources, based on hundreds of thousands of mail questionnaires and the reports of a nation-wide field staff, and are maintained on a twenty-four hour basis.

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Robert L. Simpkins, Essex Wire Corp., Detroit; E. G. Sturdevant, U. S. Rubber Co., Bristol, R. I.; H. H. Wermine, Belden Manufacturing Co., Chicago; F. H. Wetzel, the Electric Auto-Lite Co., Port Huron, Mich. and Edward D. Youmans, the Okonite Co., Passaic.

•

Manufacturers Make Sales Assignments

Electrical manufacturers have recently made the following appointments to their sales staffs:

Lincoln Electric has named G. L. Revell district manager of the Portland, Ore., office.

RCA Victor Division, Radio Corporation of America, has appointed Harold M. Winters manager of a newly-created sales region, covering the eastern central states, with headquarters at Cleveland, Ohio. The new region will include Ohio, Michigan, Kentucky, West Virginia and the western portion of Pennsylvania.

Apex Electrical Manufacturing Co., Cleveland, has appointed Jack Walter as eastern division sales manager. For the past eight years Mr. Walter has been district sales manager for the New York City area. His new eastern division territory will include all of the New England states, as well as New York, New Jersey, Pennsylvania, Delaware, Rhode Island, Maryland and Virginia.

Murray G. Day has been appointed New England representative of the National Valve & Manufacturing Co., Pittsburgh, Pa., with headquarters at 201 Devonshire Street, Boston 10, Mass. He now represents the Connery Construction Company, and Quaker City Iron Works, Philadelphia, and the Thomas Flexible Coupling Company, Warren, Pa.

•

Laduby Opens New Plant

Announcement has been made that the Laduby Co., manufacturer of electrical specialties, have moved into their new factory at 176-182 Oak St., New Haven, Conn.

•

Establishes New Offices

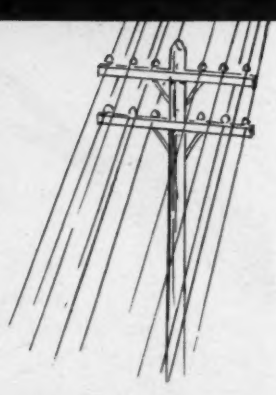
Establishment of new headquarters at 60 Beaver Street, New York, has been announced by the Fluorescent Lighting Association. The previous location at 509 Fifth Avenue which served during the formative period of the association has been discontinued.

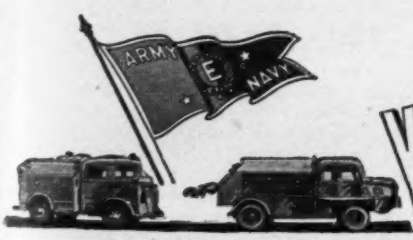
ALL ALONG THE LINE...

This is York-Hoover Model 4013-WL, a practical combination body unit incorporating capstan or horizontal winch, overhead ladder and ring assembly, ample space for tools and materials in side cabinets, telescoping roof, diamondette steel floor and sturdy understructure.

Yes, all along the line you will see these YORK-HOOVER Bodies turning in one efficient day's work after another. Their performance during these war emergencies has proven their ability " to take it." York-Hoover Public Utility Equipment Engineers designed and built these bodies. Their performance and ability " to take it " have proven that skillful engineering, the right materials and long years of experience are still the best insurance for constant, trouble-free operation.

York-Hoover engineers are planning even better construction of new equipment, light and medium duty units, as well as heavy duty line bodies; so let us help you with your future plans by producing better body equipment for you—*for tomorrow*.





YORK-HOOVER CORPORATION

BODY DIVISION

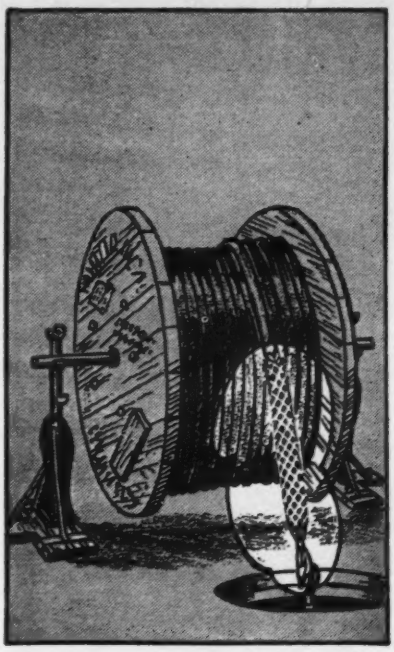
YORK, PENNSYLVANIA

SPEED

CONSTRUCTION

and EXPANSION

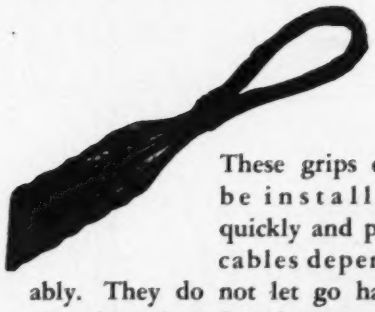
of PLANT FACILITIES



RELIABLE CABLE GRIPS

For Pulling in

Wires and Cable



These grips can be installed quickly and pull cables dependably. They do not let go halfway through a duct because the wires pull with evenly distributed load. Eight different styles — all supplied in a full range of sizes.

Reliable ELECTRIC COMPANY

OVER 35 YEARS SERVICE TO THE UTILITIES

[illegible] CHICAGO ILLINOIS

Field Reports on Business

Reports from various sections of the country indicate that war orders are declining somewhat. In the electrical field one of the outstanding features at present is the trend toward modernization of lighting facilities. Private housing construction is maintaining its high volume. Retail trade is active.

CHICAGO

Chicago business in virtually all of its important categories continued on the upgrade throughout April. Compared to the same month last year there were only two downward movements. These both occurred in the financial field where for the first time in several months bank clearings slipped slightly backward. Transactions on the local stock exchange were far under 1943.

Most radical upturn occurred in the building industry where contracts awarded in Cook County jumped 527.7 percent ahead of April, 1943. Actual investments represented were 384 percent greater than last year. Public utilities continued to reflect heavy war demands. Electric power consumption was 7.4 percent greater. Factory payrolls continued to climb uphill. With 3.7 percent more workers on the job than 12 months previously, actual wages paid in the city's factories increased 16.5 percent. More jobs and wages benefited retail trade, department store sales climbing 6.7 percent.

Recently announced construction projects in the utility and industrial field in the Chicago area include: A 2,500 kw., turbine and boiler extension to the municipal power plant at Howard, Wis.; a $522,000 building extension at the Pontiac Division of General Motors Corp., Pontiac, in which considerable electrical equipment and accessories will be required. At Huron, Mich., Mueller Brass Co. plans an extension in plant which with electrical and mechanical equipment will cost an estimated $425,000.

NEW ENGLAND

War orders are declining in the New England area. Inquiries for additional machinery for small plants are being received by WPB and a marked increase in installations of lighting in the Boston area is noted. Post-war expansion of housing facilities in several New England colleges as well as changes in laboratories and shops are being studied on a fairly large scale. New England Telephone estimates that $100,000,000 and several years' work will be needed for post-war construction and facilities. Railroad supplies are in a potentially strong position and two New England railroads are in the market for rolling stock. Chairman Herrmann and President Moore of New England Power Association foresee two post-war developments which should help earnings,—first, a reduction in taxes; and second, greater use of electricity in the home and on the farm.

Bidding on Navy requirements was less active last week. Flexible conduit connectors, fairly large stocks of wiring supplies, small tools and copper wire were handled in this area. Bids were submitted for ventilating units, 150 distribution service transformers, 3,000-watt, ship-type air heaters, thirty-six 12-in. fans, and insulating materials. Connecticut manufacturers are moving copper wire, non-ferrous welding rod, and tubing at a good rate. The New Haven Railroad has been authorized to buy buses at a cost of $270,000 and to purchase a large garage in East Hartford, Conn.

A $80,000 school has been authorized by the War Public Works Commission for Freeport, Me., and additional housing facilities costing $34,750 will be constructed at New London, Conn. Mercantile establishments in lower Connecticut exhibit a decided trend toward the modernization of their lighting facilities. Private housing developments in the Bridgeport (Conn.) district have lately shown considerable activity.

NEW YORK

War production continues generally at high levels though cutbacks and cancellation of contracts have been something of a retarding factor.

Even though some lines of economic activity reflected wide shifts, the level of business in the Pittsburgh district held about unchanged for the third consecutive week, according to an announcement by the Bureau of Business Research, University of Pittsburgh. The volume of industrial production rose somewhat, but the gain was offset by small decreases in shipments and trade.

Civil engineering construction volume for the short week due to the Memorial Day holiday totaled $23,214,000. This volume was 78 percent below the corresponding 1943 week, below the $27,885,000 reported to *Engineering News-Record* for the preceding week, and 23 percent below the previous four-week average. The week's construction brought 1944 volume to $757,233,000 for the 22 weeks, a decrease of 53 percent from $1,598,632,000 reported for the corresponding 1943 period.

With demands continuing strong for seasonal apparel and accessories, retail trade was active last week.

PACIFIC COAST

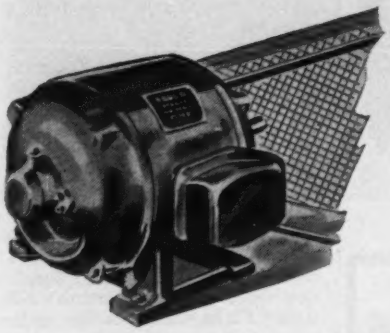
Returning service men are becoming more noticeable in western plants and business firms, though to date they have been easily reabsorbed. Swing shifts are disappearing in various industries, though airplane plants, such as Douglas at Santa Monica, which will be greatly affected by changing requirements of field and air operations, may be retooled for production of big cargo planes. Excavation has begun on 169-mile irrigation canal from Friant Dam to Bakersfield, a $21,000,000 section of California Central Valley project.

Orders cover lighting jobs averaging $30,000 for various fields in Rockies sector from Pueblo, Colo., to Wilcox, Ariz.; equipment for large cold storage warehouses in Portland and Parkdale, Ore.; relighting of many large conversions of private and public buildings for government service in the coast cities, particularly in Bay area; $25,000 of motors and controls for a submarine tender, and two main marine reduction gear equipments, costing about $600,000.

Basket weave and other ship cables are in heavy demand with very fair deliveries, a typical major order for stock sizes totaling $30,000. New government construction includes a 7,000-man expansion of amphibious training center in California; a hangar and other structures for Naval air station in Oregon; a $6,000,000 appropriation for Navy locations in California, largest being for the repair base; and $1,000,000 for flight research laboratory at Moffatt Field.

FOR *MORE* OVERLOAD PROTECTION

CHECK FIBERGLAS*!



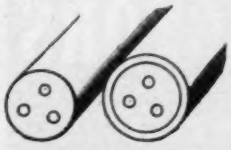
Greatly accelerated production, to meet wartime schedules, often means overloading of electric motors.

That this can be done without frequent breakdown is a tribute to both the motors and their manufacturers. But some motors have stood up better than others. Many of those with outstanding performance records are insulated with varnish - impregnated *Fiberglas* — the glass - fiber insulation.

An exclusive combination of inherent qualities makes impregnated Fiberglas a better electrical insulating material; highly efficient and with the ability to provide an extra "safety factor" against such unanticipated abuse as unusual overload.

Being inorganic and fireproof, Fiberglas is unaffected by high temperatures.

Yet unlike other highly heat-resistant materials, Fiberglas is extremely compact; permits the use of *more* insulation in limited areas than is possible with other types of high heat-resistant insulating materials.



Other basic properties of Fiberglas are: high tensile strength —resistance to acids (except hydrofluoric), oil and corrosive vapors—non-hygroscopic, does not absorb moisture - - high thermal conductivity in textile form—permanent—does not deteriorate with age—dimensional stability.

All these properties contribute to longer life and better service for electrical equipment. They make Fiberglas insulation an outstanding value.

May we suggest that you get all the facts about this better electrical insulation. Write *Owens-Corning Fiberglas Corporation, 1858 Nicholas Building, Toledo 1, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.*

FIBERGLAS ELECTRICAL INSULATION

ARMY E NAVY

*T. M. Reg. U. S. Pat. Off.

What's New in

STAGE SWITCHBOARDS

WRITE FOR YOUR COPY OF THIS NEW, INFORMATIVE BOOKLET

CUSTOM BUILT SWITCHBOARDS

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STAGE and GENERAL LIGHTING EQUIPMENT

Today our shops are almost entirely occupied with war projects such as Marine Switchboards, Stage Switchboards and Lighting Equipment for Army, Navy and Air Corps installations. But where priorities permit and materials are available, we can still fill orders for industrial and other applications.

If we or our Resident Engineer nearest you can be of assistance, please call on us. And let us send you our new booklet which describes the latest developments in Stage Switchboard design.

HUB ELECTRIC CORPORATION

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HUB-REGULITE stage switchboard at Norfolk Naval Hospital, Portsmouth, Va. Pilot control station and remote switchboard are illustrated.

BLACKBURN CONNECTORS *Reinforced* FOR STILL GREATER STRENGTH

Shown in circle is the *pressure bar* from a BLACKBURN CONNECTOR. Small arrows indicate how this bar is *reinforced* on both sides.

Actual tests prove that these reinforcements tremendously increase the bridging strength of the bar. Here's why — The connector nut can exert its pressure at only two points. But the bridge-like pressure bar distributes this pressure over the entire length of the connection. Like the tie rods on a bridge, the two reinforcements greatly strengthen the pressure bar, and give it maximum rigidity.

★ ★ ★

Millions in use throughout the world

Over 75 Conveniently-located Jobbers' Stocks

JASPER BLACKBURN PRODUCTS CORP.

Main and Clinton Sts. • ST. LOUIS (6), MO.

Builders of Quality Connectors for Over 10 Years

Recent Rate Changes

GEORGIA POWER CO. has made a reduction in rates, aggregating $1,058,000 annually, Walter R. McDonald, chairman of the Georgia Public Service Commission has announced. Mr. McDonald said there would be no change in the residential rate of the company, the reduction effective with June billings, being applied only to commercial service and to charges for electric energy sold to municipalities and REA co-operatives for resale.

PORTLAND GENERAL ELECTRIC CO. and NORTHWESTERN ELECTRIC CO., Oregon, will return to their customers more than $1,100,000 in June in compliance with an order issued by George H. Flagg, state public utilities commissioner, designed to compensate for unusual wartime earnings of the utilities. Reductions of $807,000 are being made in current bills of P.G.E., and Northwestern customers will receive $310,000 in cash refunds. Both figures equal an 86 percent discount on one month's bill. Commissioner Flagg stated similar actions may be taken as long as wartime earnings continue. Referring to the emergency rate reduction order affecting P.G.E. now at issue in the supreme court, the Public Utilities Commissioner said the present setlement should end litigation and postpone a rate hearing until operating expense and earnings of the company were nearer normal.

VERMONT PUBLIC SERVICE COMMISSION has announced a downward revision of rural line guarantees effective July 1, under which single-phase circuits will be extended for a minimum charge of $2 per month per customer where applicants average not less than three per mile. The former guarantee was $18 per month per mile, or $6 per customer. Under the new schedule, companies may extend beyond $1,760 ft. per customer if the volume of business warrants. The initial contract will be for a 5-year period, continuing for the duration of service. Estimated savings to customers now on rural lines total $15,000 per year. Seventy-five percent of Vermont's farms are now served by the companies which have filed the new schedule. These utilities are Central Vermont Public Service, Green Mountain Power, Newport Electric division of Citizens Utilities, Public Electric Light, and Woodstock Electric. Extensions continue under WPB jurisdiction for the present.

•

Take Steps to Map Power Resources of Yukon

Installation of 15 or 20 gauging stations on northern British Columbia and Yukon Territory rivers this summer will be the first step in mapping the huge power resources of the area which borders the Alaska Highway, C. E. Webb, district chief engineer of the Water and Power Bureau, Department of Mines and Resources, has announced.

"Up until the present time, there has never been any accurate measurement of the flow of rivers in northern B. C. and Yukon," said Mr. Webb.

"We estimate, however, that there are large blocks of hydroelectric power there such as could be used for electrochemical works, pulp or paper enterprises, or mining and smelting projects."

How we make Cathode Ray Tubes OF UNIFORM QUALITY AT WARTIME SPEED

This non-stop rotating oven enables North American Philips to produce cathode ray tubes in assembly line quantities despite the complex heat treatment required for uniformly high quality.

In baking out and rendering inert the binders in the "Aquadag" and fluorescent coating on the inner surfaces of the bulb, heat must be gradually raised and as gradually lowered to prevent damaging residual strains in the glass. The oven illustrated, product of North American Philips ingenuity, accomplishes this by rotating slowly racks of bulbs through zones of increasing and decreasing temperatures within the oven from room temperature to 450*C*, then down to 200*C*.

This is but one of the many innovations in engineering and production techniques which assure for NORELCO Cathode Ray Tubes a uniformly high level of performance.

Painstaking concern for perfection and constant striving for improvement characterize *all* the activities of North American Philips in the development and manufacture of NORELCO electronic products.

Various types of cathode ray, transmitting and amplifying tubes are now being produced for our armed forces, together with quartz crystals for land, sea and air-borne communication equipment.

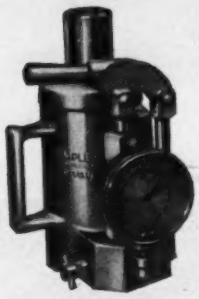
For our war industries we make Searchray (X-Ray) Apparatus for industrial and research applications; X-Ray Diffraction Apparatus; Direct Reading Frequency Meters; Electronic Measuring Instruments; High Frequency Heating Equipment; Tungsten and Molybdenum in many forms; Fine Wire in many metals and various finishes; Diamond Dies.

And For Victory We Say: Buy More War Bonds

Norelco ELECTRONIC PRODUCTS by NORTH AMERICAN PHILIPS COMPANY, INC.

Executive Offices: 100 East 42nd Street, New York 17, New York
Factories in Dobbs Ferry, New York; Mount Vernon, New York (Metalix Division); Lewiston, Maine (Elmet Division)

Cables Can't Resist Its Pull



Simplex Jenny, capacities 30, 60, 80 and 100-tons. Center hole 1⅛" to 3⅛" dia.

The Simplex Jenny Center Hole Hydraulic Puller exerts a greater pull than other cable pulling units because the cable slips through the center hole. Easier on cables, too. Also used as a pulling or pushing jack and a portable press. Turns hours into minutes on tough jobs. Ask for Bulletin 43J.

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LEVER · SCREW · HYDRAULIC
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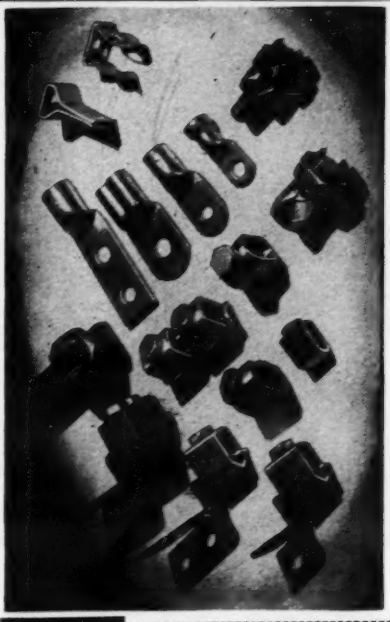
Templeton, Kenly & Co.
Chicago (44), Illinois
Better, Safer Jacks Since 1899

ILSCO
Electrical Connectors



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ILSCO COPPER TUBE & PRODUCTS, Inc.
CINCINNATI, OHIO

Sales Opportunities

CALIFORNIA—Imperial Irrigation District, El Centro, has authorized plans for new hydroelectric power plant on All-American Canal, details and capacity to be determined at early date. Project will include new transmission line for connection with present high-tension system, switching station and other operating facilities, with cost estimated close to $4,000,000. Application will be made for a priority rating. Plans will be prepared, it is understood, by William P. Creager, engineer, Niagara Hudson Power System, Electric Building, Buffalo, N. Y.

TENNESSEE—War Department, Washington, D. C., has authorized expansion in army air force specialized depot, including warehouse and other buildings, with mechanical and electrical equipment. Also will make extensions in power substation facilities, distribution lines and service connections. Entire project is estimated to cost about $650,000 and will be supervised by District Engineers Office, Mobile, Ala. Work is scheduled to begin soon.

GEORGIA—International Minerals & Chemical Corp., 20 North Wacker Dr., Chicago, Ill., plans new four-story building, about 180 x 600 ft., for commercial fertilizer manufacture to replace structure recently destroyed by fire. Cost reported over $350,000, with mechancial and electrical equipment. A priority rating is being secured and work will be placed under way soon.

LOUISIANA—Sewerage and Water Board, 522 Carondelet St., New Orleans, Robert S. Maestri, president, plans new pumping station, with motor-driven pumping machinery, controls and accessory equipment, in connection with extensions in water system. Entire project will cost about $540,000, with financing arranged through federal aid. Albert D. Wood is engineer for Board.

MICHIGAN—Fisher Body Division, General Motors Corp., General Motors Bldg., Detroit, will make extensions and improvements in branch plant known as Grand Rapids Stamping Division, for production for government, including remodeling of different plant units, and installation of mechanical and electrical equipment. Cost estimated at $2,293,000, with financing by Defense Plant Corp. Work is scheduled to begin at early date.

WISCONSIN—Northern States Power Co., Eau Claire, has secured priority rating for proposed power substation and will begin foundations and other work at once. Extensions will be made in transmission and distributing lines. Entire project will cost about $300,000.

NEW YORK—Bureau of Yards and Docks, Navy Department, Washington, D. C., will make extensions in power supply and line facilities at navy yard, including additions in power substations, transmission and distribution systems, service connections and other work, estimated to cost about $825,000 of which about $350,000 will be used for line construction. Public Works Officer at navy yard will be in charge.

OKLAHOMA—Civil Aeronautics Administration, Forth Worth, Tex., is completing plans and will take bids at once for installation of improved lighting system at airport, including about 40,000 lin. ft. of underground conduits, cable lines, 147 flush-type boundary marker lights with concrete bases, control panels, transformers, switchgear and auxiliary equipment.

MONTANA—U. S. Engineer Office, Fort Peck, plans extensions in power substation and switching station; new transmission line to be constructed by Bureau of Reclamation, Denver, Colo.

NORTH CAROLINA—Crompton Co., West Warwick, R. I., manufacturer of velvets, corduroys, etc., plans two new mills; sites of 50 and 40 acres, respectively, have been acquired. Project will be carried out as a post-war development, or as soon as materials and machinery are available. Initial mill will comprise main building for capacity of about 600 looms, and several auxiliary structures. Power supply will be furnished by Duke Power Co., which will extend transmission line to mill site, where power substation will be built. Cost reported over $500,000, with mechanical and electrical equipment.

NEW YORK—War Department, Washington, D. C., has authorized new postoffice at Madison Square Garden Bowl, Long Island City, comprising one-story building of 500,000 sq. ft. floor space for joint use of Army Postal Service and Post Office Department. Cost estimated at $1,500,000, with mechanical and electrical equipment and facilities. Project will be carried out under direction of U. S. District Engineer Office, New York.

IDAHO—Bradley Mining Co., Idaho Bldg., Boise, plans enlargement of hydroelectric power plant, used for service at mining properties including increase in height of power dam from 35 to 50 ft., and in length from 300 to 450 ft. New hydraulic turbine-generator unit will be installed, with auxiliary equipment. No estimate of cost announced. Application for permission has been made to Federal Power Commission. James P. Bradley is vice-president.

MICHIGAN—Packard Motor Car Co., 1580 East Grand Blvd., Detroit, will make extensions and changes in certain plant buildings to handle large order for parts for ambulances, taxicabs and other motor vehicles for WPB, including installation of machinery and electrical equipment. Cost estimated about $975,000. Financing will be provided by Defense Plant Corp. Work to proceed at once.

CALIFORNIA—War Department, Washington, D. C., has authorized extensions in army air base, including hangars, shops and other buildings, with mechanical and electrical equipment. Also will make additions to power substation facilities, distribution lines, service connections, lighting system, etc. Cost estimated about $720,000. Project will be carried out under supervision of U. S. District Engineer Office, Los Angeles.

DISTRICT OF COLUMBIA—Navy Department, Washington, plans extensions and improvements in telephone switching and cable equipment at different navy yards and operating bases in various parts of country, including installation of additional equipment. Entire project will cost about $500,000 and will comprise yards located in New Hampshire, Massachusetts, New York, Virginia, Louisiana, California, Washington and other points.

ROCKBESTOS A.V.C.

Takes "SPECULATION" out of Wire Performance in HOT Locations

THE ROCKBESTOS CONSTRUCTION THAT PROVIDES LONG WIRE LIFE

Rockbestos A. V. C. Power Cable, at right, and similarly insulated Motor Lead Cable (Underwriters' and Nat. Elec. Code, Type AVA) has a maximum operating temperature rating of 110° C. (230° F.) and this permanently insulated construction:

1 The conductor is perfectly and permanently centered in helically applied insulation.

2 Felted asbestos insulation, impregnated with heat, flame and moisture resisting compounds, withstands conductor heating overloads and won't dry out, bake brittle or burn.

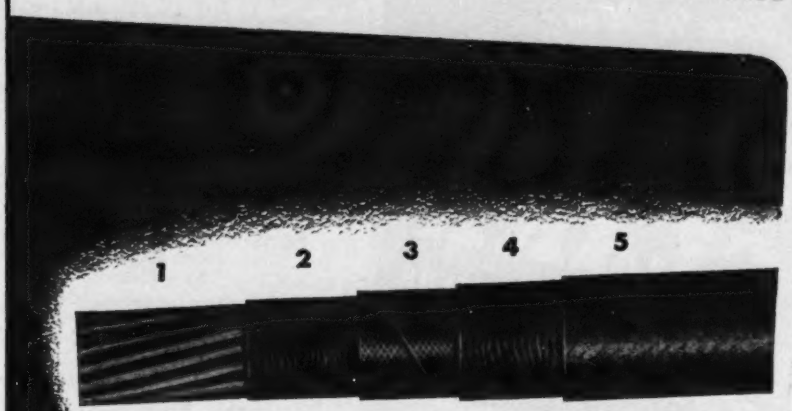
3 Lubricated varnished cambric for high dielectric strength and added moisture resistance, protected from heat, flame and oxidation between two felted asbestos walls.

4 Outer felted asbestos wall, also impregnated with heat, flame and moisture resistant compounds, serves as an effective barrier against high ambient temperatures and flame.

5 A tough, rugged asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.

One of 122 different wires and cables developed for severe operating conditions by Rockbestos.

WON'T bake brittle, bloom, burn or rot.
RESISTS moisture, oil, grease and fumes.



Take an electrical circuit that runs around or next to a hot strip mill, soaking pit, forging press, steam tunnel, lehr, kiln, etc., — and you're really "speculating" with wire performance *unless* the wire used has an insulation that will stand up under the high operating temperatures.

Rockbestos A. V. C. takes the "speculation" *out* of wire performance in hot spot locations. Its *permanent asbestos insulation* provides trouble-free circuits because it resists heat, flame, oil, grease, moisture and corrosive fumes, and won't bake brittle, bloom, flow, rot or crack under heat or severe operating conditions.

Put performance insurance in your circuits . . . wire with *permanently* insulated Rockbestos A. V. C. There are 122 standard constructions available to meet practically every service requirement When inquiring or ordering, please furnish CMP allotment number or symbol and certification. For complete information and samples, write nearest branch office or:

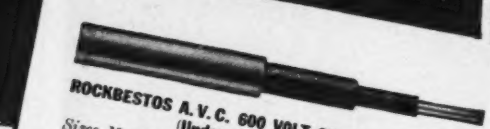
ROCKBESTOS PRODUCTS CORPORATION, 946 Nicoll Street New Haven 4, Conn.

FOR VICTORY BUY WAR BONDS

ROCKBESTOS A.V.C.

The Wire With Permanent Insulation

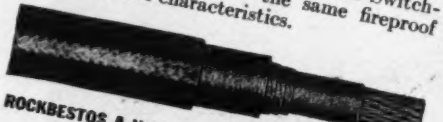
NEW YORK, BUFFALO, CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.



ROCKBESTOS A. V. C. 600 VOLT SWITCHBOARD WIRE (Underwriters' Type AVB)

Sizes No. 18 to No. 4/0 AWG with varnished cambric and impregnated asbestos insulation and gray, black, white or colored flameproof braid.

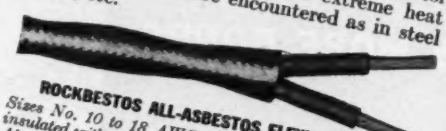
Combine fire insurance and fine appearance in your switchboards with Rockbestos Switchboard Wire. It is fireproof and will not dry out under heat. Sharp, clean bends can be made without cracking as the asbestos wall acts as a cushion under the braid. Rockbestos AVC Hinge Cable and Switchboard Bus Cable have the same fireproof and heatproof characteristics.



ROCKBESTOS A. V. C. 600 VOLT MOTOR LEAD CABLE (Underwriters' Type AVA)

Size No. 18 AWG to 1,000,000 CM insulated with two walls of impregnated asbestos and a high-dielectric varnished cambric insert, with a heavy asbestos braid overall.

Heatproof, fireproof, greaseproof and oilproof, will not dry out and crack, won't burn or carry flame, and remains permanently flexible. For coil connections, motor and transformer leads where extreme heat and fire hazards are encountered as in steel mills, etc.



ROCKBESTOS ALL-ASBESTOS FLEXIBLE CORD

Sizes No. 10 to 18 AWG with two or three conductors insulated with felted asbestos, covered with asbestos braid. Also in A. V. C. (asbestos and varnished cambric) high-dielectric constructions.

This heat-resisting flexible cord is ideal for high-wattage lighting units, floodlights, blue-print machines, apparatus, etc., which require a heavy duty, enduring cord. For moisture-resistant construction specify the A. V. C. type. Labeled cord with polarized conductors if desired.

A Name You'll Want to Remember When the War Is Won-

CLARK

ELECTRIC WATER HEATERS

A Toastmaster Product

Let's Do All We Can to Help Win the War Now-

BUY MORE BONDS!

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CLARK WATER HEATER DIVISION

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REA Allots Funds for Rural Projects

The Rural Electrification Administration has recently approved loan allotments totaling $1,096,150 to 27 rural co-operatives in 12 states. Seven of these allotments will be used to provide refrigerated locker facilities, while the remaining 20 will be used for extension of electric service to nearby farms which can aid materially in food production.

The allotments to provide refrigerated locker facilities include:

LOUISIANA—Claiborne Electric Refrigeration Co-op., Inc., Homer, $25,000.

TEXAS—Gladewater Refrigeration Co-op., Inc., Gladewater, $5,000; Upshur Refrigeration Co-op., Inc., Gilmer, $5,000; Farmers Refrigeration Co-operative, Inc., Emory, $10,000; Hill County Refrigeration Co-operative, Inc., Itasca, $6,000; Cap Rock Refrigeration Co-operative, Inc., Stanton, $5,000; Taylor Refrigeration Co-operative, Inc., Merkel, $5,000.

Details of the other allotments are as follows:

KENTUCKY—South Kentucky Rural Electric Co-operative Corp., Somerset, $60,000.

LOUISIANA—Southwest Louisiana Electric Membership Corp., Lafayette, $50,000; Northeast Louisiana Power Co-op., Inc., Winnsboro, $100,000; Pointe Coupee Electric Membership Corp., New Roads, $82,000; Claiborne Electric Co-op., Inc., Homer, $107,000.

MINNESOTA—Northern Electric Co-op. Assn., Virginia, $50,000; South Central Electric Assn., St. James, $50,000; Blue Earth-Nicollet Co-op. Electric Assn., Mankato, $50,000.

MISSISSIPPI—Jones County Electric Power Assn., Laurel, $60,000.

NORTH CAROLINA—Burke-McDowell Electric Membership Corp., Morganton, $12,500.

NORTH DAKOTA—Verendrye Electric Co-op., Inc., Velva, $113,000.

OKLAHOMA—People's Electric Co-op., Ada, $35,000; Cotton Electric Co-op., Walters, $50,000.

PENNSYLVANIA—Sullivan County Rural Electric Co-op., Inc., Forksville, $15,000; Claverack Electric Co-op., Inc., Towanda, $25,000.

SOUTH CAROLINA—Lynches River Electric Co-op., Inc., Pageland, $30,000; Salkehatchie Electric Co-op., Inc., Barnwell, $20,000.

TEXAS—Baylor Electric Co., Seymour, $60,000.

UTAH—Flowell Electric Assn., Inc., Fillmore, $31,000.

VIRGINIA—Prince William Electric Co-op., Manassas, $34,650.

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Oregon Co-op Expands

The central Lincoln County People's Utility District, Oregon, became the largest in the state as the result of recent voting in which measures to annex western parts of Lincoln, Douglas, Lane and Coos counties were passed overwhelmingly. Voters of Reedsport and Toledo turned down joining the Lincoln PUD.

COHARDITE

INSULATED TOOLS

Reduce accidents and service interruptions

8 INCH SCHOLLHORN LINEMEN'S PLIERS

List Price $4.60

COHARDITE

Insulation molded on Schollhorn 8" Linemen's plier protects the Lineman and equipment with a tested 20,000 volts dielectric. Also available in the 6" and 7" sizes with a 10,000 volt test.

Every tool tested to its full rated dielectric strength for one minute R.M.S. before it leaves our plant.

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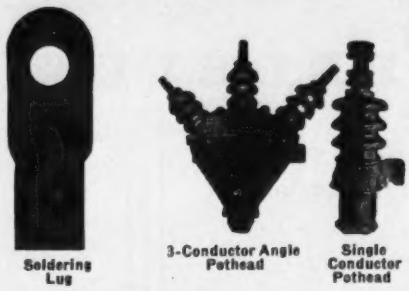

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LETTER TO THE EDITOR

Directional Concepts of the Kilovar

To the Editor of ELECTRICAL WORLD:

General power supply problems in the design and operation of generation, transmission and distribution systems frequently yield to more fortunate and direct solutions when the influences of kilowatt and kilovar flows are considered separately. An important element in keeping the studies from becoming too complicated is the use of the term "kilovar" to imply a definite positive concept for inductive reactive power. Advantage has been taken of the relative newness of the term "kilovar" to keep it free from the curse of duo-directionalism which has haunted the term "reactive kva." for many years. Evidence of this trend may be found in many articles published by the AIEE and the Electrical World. This simplifying concept has contributed to the harmony of many a productive conference of representatives of interconnected utilities. However, the situation is fraught with danger. As soon as enough people break through the misty language surrounding the definitions of kilovars, reactive power, etc., in ASA Standard No. C-42 "Definitions of Electrical Terms," doubts will be created and some heresy result, since a careful study will reveal that the definitions of that official standard (of 1942) are in direct conflict with this popular positive concept.

To gain full appreciation of the dangers besetting this carefully nurtured positive concept, it is desirable to go back a couple decades and review the unhealthy start in life and subsequent questionable reputation of the "reactive kva." Early definitions emphasizing that reactive kva. was merely pulsating power with a net value of zero led to the inference that the direction or positive concept of reactive kva. was itself indefinite. Confusion was added by such half truths as "A condenser *draws* a leading current, and therefore the rkva. flows *in* to the condenser". Attempts to define rkva. as "leading" or "lagging" have led to such reasoning as: (1) Rkva. cannot "lag"—do we mean "Rkva. associated with lagging current"? (2) The current is lagging what? (3) Lagging the impressed voltage or the induced voltage? (4) Lagging the unity power factor current? Etc. This latter pitfall so confused one engineer that whenever a steam turbo-generator was uncoupled to serve as a synchronous condenser, he had the

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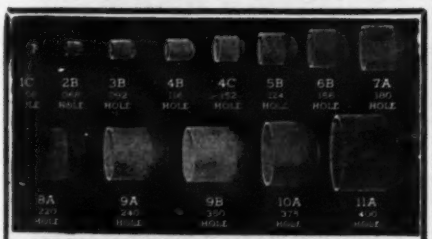

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rkva. meter (zero center) connections reversed, because naturally the "lagging" current had become "leading".

The full enormity of this confusion is apparent in the consideration of multiple path transmission systems. At a given station, kilowatts may flow *out* or *in* (with the instrument needle indicating to the right or to the left respectively) on a particular transmission line. A similar simple statement should suffice for a complete description of kilovar flow. In contrast it has been said that (1) rkva. may flow *out* or *in*, but (2) the kind of rkva. which flows thus may be either "leading" or "lagging," and furthermore (3) the kilowatt flow which is being "led" or "lagged" may be flowing either *out* or *in*. This results in eight possible combinations of *out* or *in* rkva. *leading* or *lagging* an *out* or *in* flow of kilowatts. It is small wonder that the term "rkva." came to resemble a multiheaded monster.

For the foregoing reasons many have driven the "rkva." scapegoat out of the camp, bearing on its head the sins of duo-directionalism, and have embraced the term "kilovar" with its fortunate positive concepts such as these:

(1) The common induction motor requires kilovars for its normal operation.

(2) Capacitors may be installed to provide a source of kilovars.

(3) Current flowing in an ordinary transformer produces a kilovar loss, "I^2X," as well as a kilowatt loss, "I^2R."

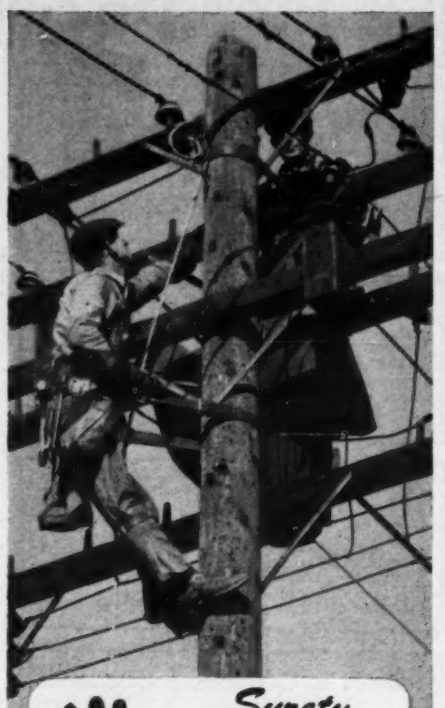
(4) When field current is increased in a generator connected to a system, kilovars flow (incrementally) into the system, just as kilowatts flow into the system when the flow of steam through the turbine is increased.

(5) A flow of kilovars from A to B causes a lowering in voltage of B with respect to A, just as a flow of kilowatts from A to B causes a similar lowering in voltage.

The simple logic of the foregoing concepts is strikingly evident. Unfortunately, there have been lapses toward "double talk" as in the following quotation, "An overexcited generator may be regarded as drawing *negative* kilovars *from* the system." This is just as unnecessary and misleading as to say that a steam generator could draw *negative kilowatts from* the system and *supply negative coal* to the bunkers.

It is therefore urged that this valuable positive concept of the kilovar be cherished. Purely academic reasoning can lead to either a positive or a negative definition, but practical considerations give overwhelming support to this positive concept.

William R. Brownlee,
Jackson, Michigan



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By DON P. CAVERLY

Commercial Engineer, Sylvania Electric Products, Inc.

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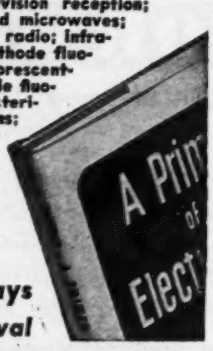

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Calculus Refresher for Technical Men. By A. A. Klaf. Whittlesey House, McGraw-Hill Book Co., New York, N. Y. 431 pages, illustrated. Price $3.

This is an ideal book for the engineer who has studied calculus but wishes a new, meticulously progressive treatment to clear up the uncertainties that come from lack of use in regular practice. Numerical examples are worked out at every step in the evolution, including some material on differential equations. The engineer will welcome particularly the closing chapter devoted wholly to a wide variety of problems encountered in technical analysis.

Illustrated Technical Dictionary. Edited by Maxim Newmark. The Philosophical Library, New York. 352 pages, illustrated. Price $5.

This is a compilation of some 5,000 technical terms as defined in official publications of engineering and technical organizations and government agencies. Items pertain to surviving and current activities in such fields as chemistry, meteorology, photography, aerodynamics, metallurgy, navigation, engineering, mechanical arts, etc. Of the total about one in six is in the field of electricity including radio and electronics. Occasional diagrams and charts elucidate obscure principles or processes. The A.S.M.E. table of scientific and engineering abbreviations is included.

Alternating Current Bridge Methods. By B. Hague. Pitman Publishing Corporation, 2 West 45th Street, New York, N. Y. 616 pages, illustrated. Price $8.50.

The fifth edition supplements the comprehensive contents of the 1938 edition by appending notes on the sensitivity of bridge networks, mutual inductometers, the Campbell M-corrector, condensers, rectifiers, thermionic detectors, bridged T-networks, the Schering bridge, stray admittances. The main text remains an authoritative analysis of bridge components and auxiliaries, the classification of the networks employed from the standpoint of pertinence to specific measurements and the degree of precision attainable. The scope and limitations of 22 different bridges are epitomized in a useful tabulation. Shielding and earth capacitances are discussed in detail.

Control of Electric Motors—2nd Edition. By P. B. Hazwood. John Wiley & Sons, Inc., New York, N. Y. 479 pages, illustrated. Price $5.

Increased content about control of synchronous motors and about adjustable-voltage controls of d.c. motors has been added to this second edition. Advances in the art during the intervening eight years also are recorded. Another improvement is the discussion of the controls adjoining the treatment of the characteristics of motors to which they are applicable. The chapter on electric excitation and relays has been brought up to date and thus the book is an authoritative and embracive source of information on motor control.

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(Classified Advertising)

Continued on pages 186, 187

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(Continued on page 186)

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300 HP. 514 RPM. 3/60/440 V. Westinghouse

ADJUSTABLE SPEED MOTORS
20 and 25 HP. 230 Volt DC 250-1000 RPM. Gen. Elec.

AC-GENERATORS
150 KW. 225 RPM. 3/60/2300 V. Ft. Wayne TRC
150 KW. 600 RPM. 3/60/220 V. General Elec. ATB
200 KW. 720 RPM. 3/60/440 V. General Elec. ATB

ENGINE-GENERATOR
60 KW. 3/60/220 V. Westinghouse-Ideal complete

OIL ENGINE
20 HP. Fairbanks-Morse Type Y Style H horizontal

ROCKFORD ELECTRIC EQUIPMENT Co.
713 So. Wyman St. Rockford, Illinois

OPPORTUNITIES!

in

New and used equipment recently released from service by a number of electric and gas utility companies.

POWER PLANT EQUIPMENT
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EBASCO SERVICES INCORPORATED
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We have several thousand transformers in stock for prompt shipment, and invite your inquiries.

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"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI 27, OHIO

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CORRUGATED CARTONS

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142 East 32nd Street New York 16, N. Y.

SUCCESSFUL OPERATION GUARANTEED

Every Machine in This Ad is Owned Outright By Us

D C MOTORS

	HP	Make	Type	Volts	Speed
2—	1250	G.E.	MPC	550	130
1—	1200	Whse.	Compen.	550	600/720
1—	800	G.E.	MPC	660	600
2—	625	G.E.	MPC	500	130
1—	600	G.E.	MPC	600	650/900
1—	600	G.E.	MPC	230	900
1—	500	Whse.	Compen.	250	240/720
1—	300	G.E.	DMC	230	400/600
1—	300	G.E.	MPC	230	275/550
2—	270	Whse.		550	250/500
1—	250	G.E.	C	230	375
1—	250	Al. Ch.		230	525
2—	200	Whse.		230	400
1—	175	Whse.	SK	250	150/525
1—	150	G.E.	RC-19A	230	800/1000
1—	150	G.E.	MPC	230	250/450
2—	130	Cr. Wh.	CMC-65H	550	1200
2—	125	G.E.	CO-1832	230	625
2—	100	G.E.	LC-50	230	1200
1—	100	G.E.	MPC	230	225/450
1—	100	G.E.	RC-19	230	575/720
1—	75	G.E.	LC	230	500/1000
2—	75	Whse.	SK-183	230	560/1100
1—	60	El. Dv.	258	230	525/1050
2—	50/60	Cr. Wh.	65H	230	500/1000
1—	50	Cr. Wh.	CMC-81H	230	300/900
9—	50	G.E.	RF-16	230	400/1200

TRANSFORMERS

	KVA	Make	PH	Type	Voltage
6—	1667	Pitts	1	OISC	13200x2300
1—	1050	G.E.	3	WCTH	11000x445
1—	600	G.E.	3	HT-OISC	11550x2200
3—	333	Moloney	1	C-OISC	22000/11000x2300/575
2—	333	Whse.	1	OISC	2300x460
2—	333	Pitts.	1	OISC	2400x220
3—	300	G.E.	1	H-RP	13200x575/1150/2300
1—	300	Pitts.	3	ODSC	4150x208/120
3—	360	Packard	1	OISC	2200x220/440
3—	200	G.E.	1	H-LDD	26400x115/460
3—	200	G.E.	1	H-OISC	2300x115/230

MOTOR GENERATOR SETS

3 ph. 60 cycle

1—1500 KW GE 275 V. Gen. d.c. to 2100 HP, 2300 V. Syn. Motor
1—1500 KW Whse 250 v DC to 2100 HP 4400/2200 v.
1—1000 KW Whse. 600 V. Gen. d.c. to 1400 HP 4000 V. Syn.
1—500 KW GE 600 V. DC Gen. d.c. to 700 HP—2200/13200 V. Syn. Motor with Exciter.
1—400 KW G. E. 250/275 V. Gen. to 700 HP ATI 440/2300/4000 V. Motor
1—350 KW G. E. 229 v AC Gen. d.c. to 500 HP 350 v DC motor.
1—75 KW G. E. 125 V. Gen. to 120 HP IK 4000/2300 V. motor.
1—50 KW GE 125 V. Gen. to 75 HP KT 4000/2300 V. Ind. Motor.

TURBO GENERATOR SET

1—500 KW, Whse. 625 Kva., 440 V., 3 ph., 60 cy., 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.

ROTARY CONVERTERS

60 cycle

	KW	Make	Speed	D.C. Volt	Trans. Volts
1—	1500	Whse.	720	600	2300
1—	1500	Whse.	600	600	11500
1—	1250	G.E.	720	250	2300
1—	1000	G.E.	900	600	132000
1—	1000	Whse.	600	250	22000
1—	1000	Whse.	900	600	11000
1—	750	G.E.	1200	600	2300
1—	750	Whse.	720	250	6600/2300
1—	500	Whse.	1200	600	13200/2300
1—	375	G.F.	1200	250	6600/2300
2—	300	G.E.	1200	600	2300

25 cycle

2—	1500	G.E.	500	225/275	13200/6600
1—	500	G.E.	750	225/275	13200/6600

All units can be furnished with AC and DC controls.

A. C. MOTORS

3 ph. 60 cycle

Synchronous

	HP	Make	Type	Volts	Speed
1—	600	Al. Ch.		2200	720
1—	500	G.E.	TS	440	360
1—	225	G.E.	ATI	240	600
1—	125	G.E.	ATI	220/440	900
1—	100	Whse.	G	2200	1800
1—	109	G.E.	ATI	220/440	720
1—	75	G.E.	TS-7556	220/440	600

Slip Ring

1—	1200	Cr.-Wh.	801-Q	2200	237
2—	1000	Whse.	CW	2300	720
1—	800	Whse.	CW	440	357
1—	800	Al. Ch.		440	885
2—	600	G.E.	IP	440/2200	720
1—	450	Whse.	CW	2200	875
1—	400	G.E.	IP	440/2200	600
1—	400	Al. Ch.		2300	505
1—	350	G.E.	IM	2300/4000	257
1—	300	Whse.	CW	440	585
1—	300	G.E.	IM	440	720
1—	250	G.E.	MT	4000/2300	257
2—	200	Whse.	CW	2200	514
1—	200	G.E.	IM	440	600
1—	150	Whse.	CW-772C	2200	1160
1—	150	G.E.	IM-17	2200	435

Squirrel Cage

1—	530	G.E.	1-17B	2200	695
1—	300	Whse.	CS	550	580
1—	300	G.E.	IK	2300	600
1—	175/112	G.E.	IK	440	900/720
1—	125	Whse.	CS	220/550	1150
1—	125	G.E.	IK	220	720

SYNCHRONOUS CONDENSERS

1—	1000	G.E.	ATI	2200/3800	900
1—	750	G.E.	ATI	220/440	900
1—	600	G.E.	ATI	220/440	900

RE-NU-BILT BELYEA MOTORS

What are your requirements? units up to 5000 kw available in stock.

BELYEA COMPANY INC.

Main Office & Shop: 51 HOWELL ST., JERSEY CITY, N. J.

J. L. HEMPHILL & CO. Inc.
ELECTRICAL ENGINEERS AND EQUIPMENT
1602 53rd Street, North Bergen, N. J.

N. Y. C. Tel.: LOngacre 5-3227—N. J. Tel.: UNion 3-2600

MOTOR—3 PHASE 60 CYCLE

1—500 HP, 900 RPM, 440 volt, Lincoln slip ring
1—400 HP, 514 RPM, 440 volt, Westg., slip ring
1—335 HP, 600 RPM, 2300 volt, G.E. syn.
1—500 HP, 900 RPM, 440 volt, Lincoln slip ring.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E., sync.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v. G.E., sl. rg.
1—150 HP, 1800 RPM, 440 volts, G.E., sq. cg.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
2— 75 HP, 1200 RPM, 2300 volt, G.E., vertical

MOTORS—D. C. 230 VOLTS

3—450 HP, 400 RPM, General Electric MPL.
1—250 HP, 760 RPM, Electro Dynamic.
2—150 HP, 550 RPM, Westinghouse, SK.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, 625 RPM, G.E.
1— 90 HP, Crocker-Wheeler, 600 RPM.
1— 75 HP, 950 RPM, General Electric
1— 50 HP, RPM, Westinghouse, type SK.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v. Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—200 KVA, G.E., 2200-220/440 volts.
3—200 KVA, Allis-Chalmers, 2200/220/440
3—150 KVA, G.E., 33,000 2300/4000 Y.
3—100 KVA, Westinghouse, 11,430/250 volts.
3—100 KVA, G.E., 2200-220/110 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—100 KVA, Allis-Chalmers, 2200/220/110
3—100 KVA, Allis-Chalmers, 2400/4150Y-2400
3— 75 KVA, General Electric 2200/220/440.

MOTORS GENERATOR SETS

1—750 KW, 250 volt, Allis-Chalmers, synchronous.
1— 75 KW, 125 volt, General Electric, squirrel cage.
1— 6 KW, 125 volt, General Electric, squirrel cage.

MOTORS—VARIABLE SPEED 230 VOLTS

1—100 HP, 475/1425 RPM, Electro Dynamic
1— 90 HP, 470/940 RPM, General Electric.
1— 75 HP, 525/1575 RPM, Electric Dynamic.
1— 35 HP, 500/1500 RPM, Westinghouse.
1— 35 HP, 350/1050 RPM, Electric Dynamic.
1— 30 HP, 225/900 RPM, Crocker-Wheeler.
2— 25 HP, 300/900 RPM, Electro Dynamic.
1— 20 HP, 750/1500 RPM, General Electric.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker-Wheeler.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—225 KVA, 514 RPM, 600 volt, Westinghouse.
1—200 KVA, 3600 RPM, 240 volt, Allis-Chalmers.
1—62½ KVA, 3600 RPM, 220 volt, Allis-Chalmers.

TURBO-GENERATORS

600 KW, Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

ENGINE GENERATOR SETS

1—150 KVA, General Electric Generator, Ames Uniflow engine.
1—62½ KVA, Westinghouse Generator, Fairbanks company engine.

Complete Line of A.C. and D.C. Motors and Generators

FREQUENCY CHANGER

1000 KW, 460 volts, 3 phase, 25 cycle,
300 RPM, 1570 amperes, serial 4,900,000,
1250 KVA 0.8 p.f. 50-deg. rise General Electric, type ATI-10-1250M-300, with amortisseur winding, with 33 KW direct-connected exciter, with
1400 HP 460 volts, 3 phase, 60 cycle,
300 RPM General Electric, 1570 ampere
1250 KVA p.f. 0.9, 50-deg. type ATI-24-1250M-300 form C, with amortisseur winding.

CHICAGO ELECTRIC CO.

1314 W. Cermak Rd. Chicago, Ill.

New "SEARCHLIGHT" Advertisements

received by Monday, will appear in Saturday's Issue, subject to limitations of space available.

Address copy to the Departmental Advertising Staff
Electrical World
330 West 42nd St., New York City

1 portable G.E. Thomson A.C. 60 Cy. Ammeter
Scale 0-250—Type P.—#349582

1 Westinghouse Current-Transformer
25-133 Cycles, Type K.A.—250 Amp. 6900 Volts

FS-712, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

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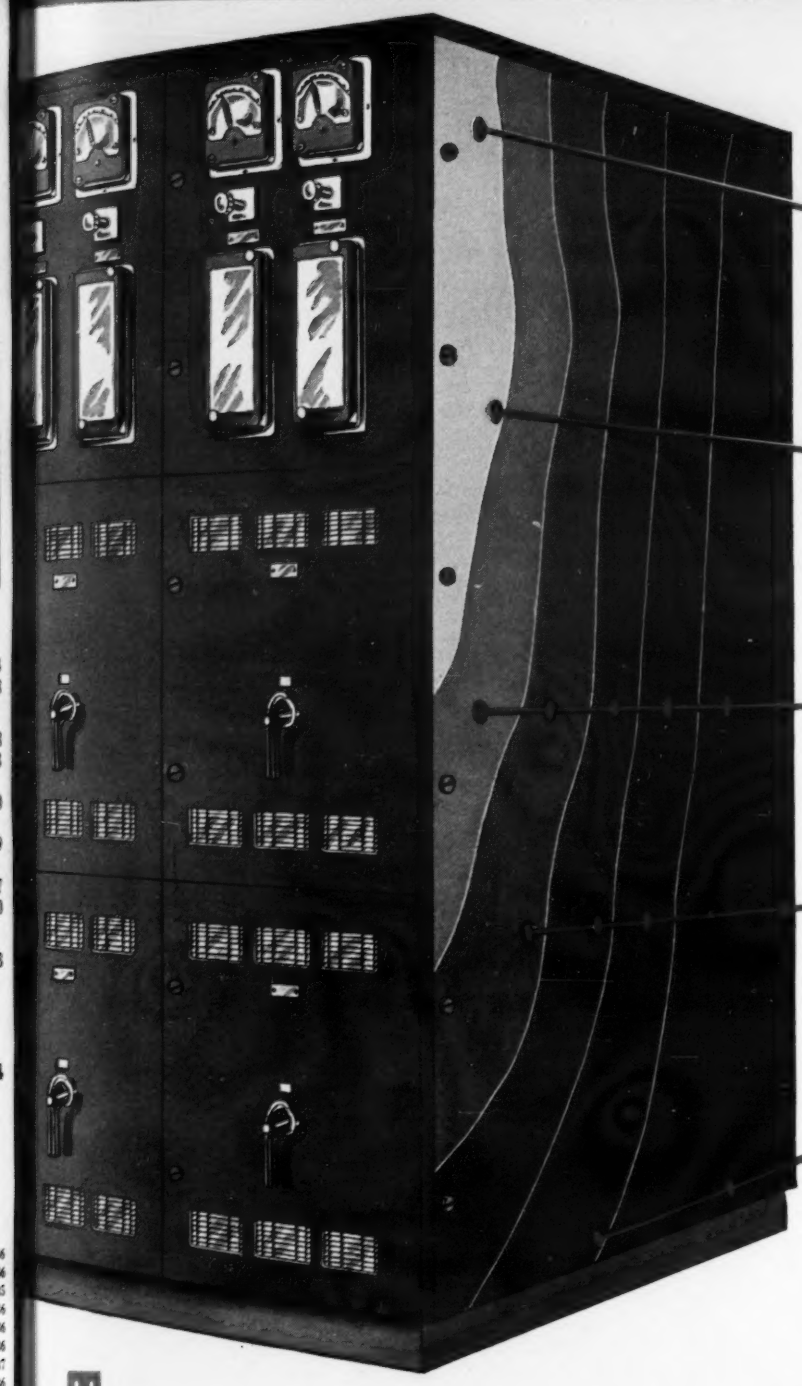
★ **These companies have supplied additional buying information on their products in the 1944 edition of the Electrical Buyers' Reference**

ALL THIS EXTRA SURFACE PROTECTION

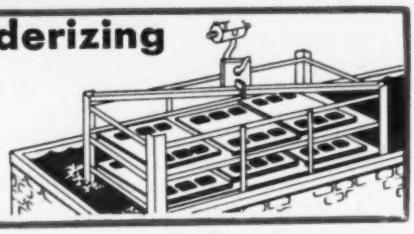
without added cost to you . . . in

I-T-E DRAWOUT SWITCHGEAR



3 Cleaning Operations

Bonderizing



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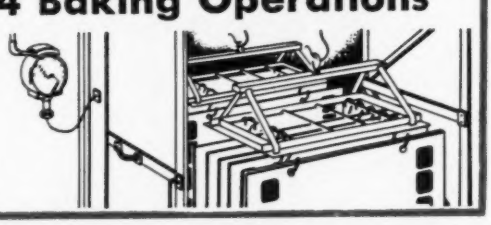


2 Mechanical Rubbing Operations

The extra work that I-T-E puts into the finish of a Multumite structure is in the user's interest. Electrically and mechanically I-T-E switchgear is built to serve for years and the finish is in keeping. Your first gain is in maintaining a clean structure. Your second is preservation of the metal. The third—and not the least important—is that after years of use your Multumites will look their part as dependable servants and will continue to earn your respect.

I-T-E employs the best of modern materials and practices. Processing has been standardized in our plant so that finishing operations do not penalize delivery. Equipment and skills combine to give you a definitely superior finish without added charge.

I-T-E engineers will gladly go into all details of Multumite design, operation and construction. Ask the I-T-E representative nearest you or write to I-T-E Circuit Breaker Company, 19th and Hamilton Streets, Philadelphia 30, Pa.

Representatives in Principal Cities

I-T-E AIR SWITCHGEAR

ARMY E NAVY

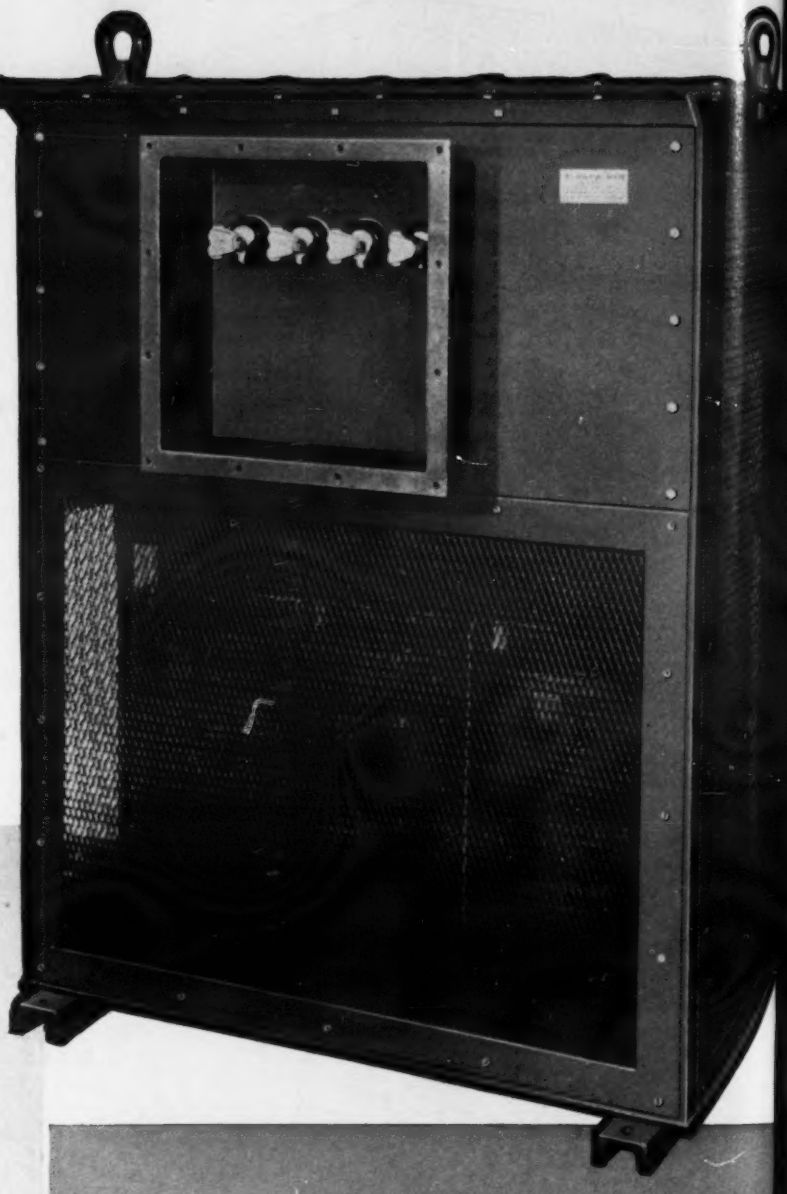
I-T-E

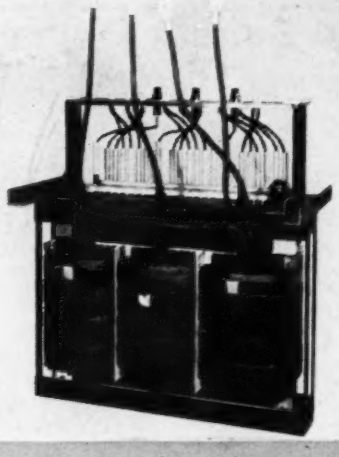
Kuhlman DRY TYPE TRANSFORMERS

REDUCE MAINTENANCE
SAVE FLOOR SPACE

This 150 KVA, three phase, 60 cycles, 4800 —120/208 Y volt unit is typical of the Kuhlman Dry Type Transformers with class B insulation that are performing so efficiently for the power and manufacturing industries.

Kuhlman Dry Type Transformers are preferable for inside plant installations, to oil-cooled units for 1) insulating a circuit from the source of supply (as a lighting circuit from a power circuit) 2) Operating low voltage portable tools from power circuits instead of lighting circuits, 3) Distributing power at 480 or 600 volts and stepping it down to 120 volts at strategic points, 4) Boosting voltage to correct for voltage drop in plant wiring, 5) Balancing voltage on a single phase 3-wire system, obtaining a three-wire circuit from a two-wire system and changing from three-phase to two-phase. For complete facts about Kuhlman Dry Type Transformers, write for Bulletin 39-10.





Buy Another War Bond Today

American soldiers and marines backed by the navy and coast guard are struggling bitterly with the enemy in Europe and in the malaria infested islands of the Pacific. American Pilots are giving all they've got to knock out Germany's war machine and air force. All over the world our boys are fighting, dying, to preserve America's freedom. The least we can do is buy War Bonds—and more bonds—until final victory is won.

KUHLMAN ELECTRIC COMPANY • BAY CITY, MICHIGAN